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COLLECTIVE REVIEW

THE SURGICAL TREATMENT OF DUODENAL, GASTRIC, AND ANASTOMOTIC ULCER WITH ESPECIAL REFERENCE TO VAGUS RESECTION

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DECIDED differences of opinion exist at present concerning the position that vagus resection, erroneously known as vagotomy, occupies in the surgical management of peptic ulcer. On the one hand, such eminent surgeons as Allen, Lahey, St. John, Walters, and Wangensteen (to mention but a few) believe that this operation has little to offer and may even be fraught with serious consequences when supplemented by a gastric drainage procedure. They either vigorously condemn vagus resection in its entirety or, at most, justify its employment in restricted instances only.

In contrast, a number of distinguished surgeons, most notably Dragstedt, insist that division of the vagus nerves, most often combined with simple gastrojejunostomy, is not only physiologically sound but more satisfactory than partial gastrectomy. Some, therefore, recommend it as the procedure of choice in virtually all cases of chronic peptic ulcer except those in which the ulcer is in the stomach and lends itself readily to removal.

In the main, however, impressions are less well formed, and whereas the enthusiasm for vagus resection seems to have waned somewhat of late, there still prevails a general state of confusion and indecisiveness. This is somewhat surprising as several years have elapsed and many thousands of vagus resections have been performed since Dragstedt and Owens' initial communication in 1943. The striking success they experienced with division of the tenth cranial nerves just proximal to the esophageal hiatus rekindled an interest which had been smoldering since the turn of the century. This operation met with wide acclaim and was soon being employed without full recognition in all instances that it was in the stage of being assessed and was not an established procedure. Several large series, however, were carried out and followed carefully at centers where adequate facilities were available for long-term critical surveillance. Even so, a clear definition of the value of vagus resection in the treatment of peptic ulcer has failed to materialize and time, in fact, appears only to have accentuated the controversy.

This divergence of opinion seems to be the consequence of several factors, chief among them being the wide latitude in the interpretation of what constitutes a satisfactory result. Nor has the personal equation always been absent from this appraisal. Thus, most of the adverse criticism of vagus resection has come from those in whose hands partial gastrectomy is associated with excellent results and a remarkably low mortality rate. Not only has there been an understandable reluctance on the part of these surgeons to employ vagus resection, but they have been prone to condemn it on theoretical grounds or as quickly as untoward manifestations appeared.

In contrast, proponents of the nerve operation emphasize the higher mortality rate associated

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with partial gastrectomy and contend that vagus resection is followed by a lower proportion of unfavorable postoperative sequelae, particularly when gastroenterostomy or pyloroplasty is added. When failures occur after vagus resection, these are attributed mainly to an incomplete division of all the nerve filaments.

Supplementing vagus resection with a gastric drainage procedure has, of course, further heightened the perplexity, for it has long been recognized that the latter operation is, in itself, productive of excellent immediate, although often temporary, results. Another prominent source of confusion arises from attempts to compare statistically treated surveys in which the severity of the ulcer has been disregarded. This omission obviously renders such studies meaningless for the most part and invalidates the conclusions drawn therefrom.

The present dilemma, therefore, cannot be ascribed altogether to the absence of long-term follow-up studies, admittedly important as these will be in the final evaluation of vagus resection. A good deal of information has been accumulated and already many incontrovertible principles regarding this procedure have been established. It is the purpose of this communication to emphasize these and to attempt to define the present position of vagus resection as it relates to other surgical measures employed in the treatment of chronic peptic ulcer.

A cursory review of the innervation and principal activities of the stomach and related organs of digestion may prove helpful for a proper orientation regarding the problems involved. Also, the current concept of the pathogenesis of ulcer will be summarized in an effort to elucidate the premise upon which vagus resection is based.

Innervation of the Stomach and Related Viscera

The gastrointestinal tract is supplied by intrinsic as well as extrinsic innervation. The latter consists of both the sympathetic and the parasympathetic components of the autonomic nervous system and, of course, innervates the other abdominal viscera as well as the stomach.

INTRINSIC INNERVATION

The intrinsic nervous mechanism is under the influence of the extrinsic nerves. It is composed of at least two distinct but interrelated plexuses, the plexus of Meissner, contained within the submucosa, and the plexus of Auerbach, between the muscular layers. These nerve nets provide the alimentary canal with independent local automatism and appear to aid in the correlation of motor and secretory activities. Thomas and Komarov suggested that the intrinsic nerves are capable of conducting impulses over considerable distances. If this is the case, it is conceivable that since the vagi supply the esophagus segmentally with numerous filaments terminating in close proximity to the myenteric plexus, division of the major vagus trunks at the level of the diaphragm may fail, on some occasions, to deprive the stomach of impulses extending intramurally from higher levels.

EXTRINSIC INNERVATION

Sympathetic. Visceral efferent impulses are conveyed from central ganglia in the diencephalon to preganglionic neurons, the cells of which lie in the intermediolateral column of the spinal cord. Their axons emerge over the lower 7 or 8 pairs of thoracic nerves, leave through the white rami, and continue, generally without interruption, through the corresponding ganglia of the paravertebral chain. The fibers then join to form the greater (5–10 T.), lesser (10–12 T.), and least (12 T.) splanchnic nerves which extend distally and descend between the crura of the diaphragm to terminate in preaortic ganglia.

The largest of these, the celiac, consists of two semilunar structures adjacent to the celiac axis with connections to the other visceral ganglia. Within the celiac ganglia the terminal filaments of the greater splanchnic nerves form synaptic connection with postganglionic fibers destined for the stomach and terminal esophagus. The celiac ganglia also receive preganglionic vagal axons but these continue without interruption and, together with postganglionic sympathetic fibers from the celiac and subsidiary ganglia, follow the periarterial plexuses to the other abdominal viscera. The sympathetic fibers ramify throughout the muscle layers whereas the vagal fibers terminate adjacent to, or possibly in connection with, the myenteric plexus. Afferent sympathetic fibers commence in sensory endings and, without forming synaptic connections, extend along the corresponding efferent pathways to their cells in the posterior root ganglia. Central connections are then established with cells in the posterior horn.

In a restricted sense it may be said that the sympathetic and vagus nerves are antagonistic in their action, the end result representing a balance of the opposing mechanisms. While the sympathetic nerves appear to exert little influence on secretion (except slightly through vasoconstriction), they are believed to inhibit motor activities of the smooth muscles with the exception of the sphincters. The afferent neurons convey visceral

sensation and the pain incident to irritation and luminal distention.

Parasympathetic. The vagus supplies the alimentary canal with parasympathetic innervation as far as the proximal third or half of the transverse colon. It is a mixed voluntary-involuntary nerve originating in the medulla from 3 groups of cells, one of which, the dorsal nucleus, gives rise to the visceral component. The preganglionic efferent axons, unlike those of the sympathetic division, extend without interruption to the viscera.

In its descent through the mediastinum the tenth cranial nerve supplies the adjacent esophagus with numerous small filaments, some of which, according to Bradley and his associates, occasionally extend within the wall and emerge at a lower level. In most instances the right and left vagus nerves accompany the esophagus through the hiatus of the diaphragm as 2 distinct trunks. However, recent anatomical investigations by Bradley and his associates, Doubilet and his associates, Miller and Davis, and others demonstrated that the fibers may be widely dispersed at this level. This fact emphasizes the need for painstaking dissection whenever the nerve operation is done if aberrant nerve strands are not to be overlooked and the purpose of operating defeated.

Just proximal to the cardia the left vagus sends a large filament to the pylorus, the first portion of the duodenum, and the hepatic plexus. It then courses along the lesser curvature, ramifying throughout the ventral wall of the stomach. The right vagus, located posteriorly and somewhat to the right, supplies branches to the dorsal surface of the stomach as it descends distally toward the visceral plexuses. Long afferent fibers extend, also without interruption, to their cells in the jugular and nodal ganglia. From here stimuli are relayed to central stations.

Although its effect on gastrointestinal function is not entirely clear, the vagus appears to be predominantly an augmentor nerve. It increases blood flow, stimulates secretion, and heightens motor activities except at the sphincters. The afferent fibers convey reflex and other sensory stimuli, but probably not those of visceral pain. Dragstedt and his associates, Ruffin and White, and others showed that patients still perceive pain-provoking stimuli after division of the vagi. However, instances of painless perforation of an ulcer subsequent to this procedure have been reported by Weeks and his associates and Walters and his associates, among others.

The vagi may not be the sole source of parasympathetic supply to the stomach. Hollander suspects that "vagomimetic nerves of spinal origin" may, on occasion, also convey such impulses. Moore is of a similar opinion and suggests that after vagus resection visceral activities tend, in time, to return to their preoperative level as a result of the arousal of "latent cholinergic reactions in the splanchnic nerves."

Hence, there is reason to believe that the attainment of complete vagal interruption may prove technically difficult, if not impossible. Moreover, of greater significance is the fact that vagus resection may be futile if parasympathetic impulses utilize other pathways.

Activities of the Stomach and Related Viscera in Digestion

The Stomach

The principal function of the stomach is to prepare food suitable for acceptance by the small intestine where digestion is completed and absorption takes place. This is accomplished by means of secretory and motor activities, that is, chemical and mechanical disintegration of the meal. The resulting mixture (chyme) is discharged through the pylorus at periodic intervals.

Secretory activity. Gastric juice is secreted continuously in the human being although the flow is by no means as copious during the resting state as it is during a meal. The mechanism responsible for the interdigestive component of secretion is not entirely clear; however, it is well recognized that a prominent role is played by cortical influences mediated through vagus nerves.

A pronounced rise in the volume and degree of acidity is usually observed during the interdigestive period and especially during the night (nocturnal secretion) in persons with duodenal ulcer, but not in those with gastric ulcer. This discrepancy is probably due to secretory cell inhibition in the latter instance, the result of coexisting gastritis.

Phases of digestive secretion. The cephalic phase of digestive secretion, also known as the psychic or neural phase, consists of the initial 20 to 30 minutes of digestion. During this period secretion occurs as a consequence of conditioned reflexes from psychic or appetite stimuli, mediation taking place entirely through the vagi. This, the "appetite juice," is rich in pepsin as well as hydrochloric acid and, therefore, may possibly be capable of greater proteolytic activity than the secretion of the second or gastric phase.

The experimental studies of Pavlov and his coworkers clearly demonstrated, at the turn of the century, that division of the vagi inhibits the flow

of appetite juice. Subsequently, Carlson showed that while this diminishes secretion, it does not abolish the humoral or hormonal (gastric) phase.

According to Alvarez, Okada and his associates demonstrated experimentally in 1930 that hypoglycemia, induced by the injection of insulin, usually provokes the secretion of appetite juice, presumably by stimulating the central parasympathetic centers. Moreover, they found that this effect could be inhibited by severing the vagi. These observations have been popularized in recent years by Hollander and his associates as a method of ascertaining the magnitude of neural influence in secretion as well as the physiologic sufficiency of a vagus resection. This is commonly known as the insulin test.

The gastric phase of digestive secretion is of longer duration and the secretion results principally from influences acting upon the stomach proper. The mechanisms involved, however, are not understood in their entirety. Distention of the gastric lumen occasionally stimulates the flow of small quantities of juice. This is of little moment, however, as compared with the excitation caused by such food derivatives as meat extracts and products of peptic hydrolysis. Evidence has accumulated, suggesting that such secretagogues, by their action upon the gastric mucosa (probably not on the antral mucosa alone as Edkins hypothecated), give rise to a hormone which stimulates the glands of the fundus. Many observers contend that this effect is occasioned simply by the liberation of histamine. In any event, the injection of histamine has proved to be a useful method of stimulating the flow of gastric juice and is being utilized to reflect the status of the gastric or chemical phase of secretion.

That the gastric phase is under vagal influence as well is suggested by the fact that histamine-provoked secretion tends to be diminished after the interruption of these nerves. Thomas and Komarov attribute this to a failure on the part of the stomach to respond to secretory stimuli because of the gastric atonicity incident to vagus resection.

In the intestinal phase a small amount of gastric juice is secreted when the acidified chyme leaves the stomach and comes in contact with the intestinal mucosa. The exact mechanism responsible for this phase also is not understood clearly. It seems probable, however, that it too may be humoral in character, the result of split digestive products in the food acting upon the mucosa. The vagi appear to be concerned in this phase as well.

Motor Activity. The smooth muscles of the stomach possess two principal types of motor activity—tonus and peristalsis. Tonus is a continuous or reactive state which enables the gastric wall to be kept in close approximation to the ingesta and the capacity of the stomach to be altered with a minimal change in intraluminal pressure. Peristalsis consists of rhythmical contractions, possibly involving all layers of the gastric wall when the contractions are vigorous, and only the mucosa and muscularis mucosa when the force is of small amplitude.

Although the basic mechanisms responsible for these activities are not entirely clear, they appear to be governed chiefly by the inherent intramural plexuses and conditioned through the extrinsic nerves, vagi and sympathetics. As indicated previously, these components seem in general to exert somewhat of a diametrically opposed effect, the former augmenting, the latter inhibiting. The relationship between psychic or emotional upsets and motility disturbances has been clearly evident since Beaumont's classical direct observations on his patient, Alexis St. Martin, in 1825.

Motor activities also appear to be heightened somewhat by a hormone liberated during the peak of the digestive cycle. Normally the stomach varies between a state of atony with retention and one of hypermotility with rapid emptying. When unpleasant gastric sensations arise, these are most likely to be the consequence of motor rather than secretory disturbances.

The proximal two-thirds of the stomach serves as a reservoir where food is moistened and softened. Its motor activity is largely that of tonus and only rarely does vigorous peristalsis manifest itself here. On the other hand, the distal one-third of the stomach macerates food particles, preparing them to be received by the duodenum. This is the site of pronounced motor activity; that is, peristalsis and rhythmical changes in tonicity, especially at the height of gastric digestion.

Peristaltic waves commence weakly in the mid-portion of the stomach but increase in amplitude as they descend toward the pylorus and as digestion progresses. They exhibit definite individual differences and are conditioned by such factors as the quantity and composition of the meal, the emotional state of the individual, the presence of pain, and so forth. These factors, among others, also govern the rapidity with which the stomach empties itself since the principal activity related to this mechanism is antral peristalsis.

THE SMALL INTESTINE

Secretion. The flow of intestinal juice, succus entericus, is under both nervous and hormonal control. The extrinsic nerves by mediating

psychic and cortical influences modify this secretion to a small extent. However, the production of succus entericus is fundamentally dependent upon the reflex response of the intrinsic nerve plexuses to the mechanical stimulation of ingesta.

The secretion of intestinal juice is also related to hormonal activity, a function which remains as yet incompletely understood. Some observers are of the opinion that secretin (the hormone liberated when gastric chyme comes into contact with duodenal mucosa) stimulates the flow of succus entericus and of bile as well as of pancreatic juice. In recent years a similar, although more specific, hormone capable of provoking the secretion of succus entericus has been isolated from intestinal mucosa (enterocrinin).

Motor activity. The small intestine also possesses tonus and motility. Like that of the stomach, its tonus is dependent upon the intrinsic nerve plexuses and is influenced through the extrinsic nerves (increased through vagus, decreased through sympathetic). Motility is usually characterized as pendular, segmenting, and peristaltic movements. While the mechanism responsible for peristalsis is similar to that of tonus, pendular and segmenting movements are myogenic in character and appear to be independent of either intrinsic or extrinsic innervation.

BILE

Secretion. The production of bile is likewise under both neurogenic and hormonal or humoral control. Secretion may be accelerated by cortical impulses acting through the vagi. The hormonal or humoral mechanism is, however, much the more important factor and is capable of maintaining bile production in the absence of extrinsic innervation. Little is known concerning the relationship between the autonomic nervous system and the numerous other functions of the liver.

Gall bladder evacuation. Emptying of the gall bladder is similarly dependent upon a dual mechanism, neurogenic and hormonal. The former is of subsidiary importance and the function of the gall bladder seems to be unimpaired when dependent upon the latter mechanism alone. In recent years a hormone, specific for gall bladder contraction, has been isolated from the duodenal mucosa. Known as cholecystokinin, its production or liberation is related, as is that of secretin and enterocrinin, to contact of the acidified and excitatory products in the chyme with the duodenal mucosa.

THE PANCREAS

External pancreatic secretion, like that of the stomach and small intestine, is dependent upon both neurogenic and hormonal regulation. In contrast, however, the interruption of vagal innervation does alter the character of the pancreatic juice since the production of ferments is controlled principally through the vagus. The secretion of water and inorganic elements, on the other hand, is related to the hormone, secretin. The liberation of insulin appears to be independent of direct neurogenic influence.

Immediate Effects of Vagus Resection Upon These Activities

Complete interruption of the vagus nerves is followed immediately by pronounced physiologic alterations. In fact, some observers contend that thorough division is hazardous and point out that death frequently occurs in the experimental animal. These changes, however, are not apt to occur unless all of the nerve pathways are interrupted. This is in keeping with a fundamental maxim in surgery of the autonomic nervous system: all fibers must be included if division is to be effective. A striking illustration of this principle is observed experimentally in that vagal stimulation fails to elicit a secretory response in a completely denervated gastric pouch whereas a copious flow will be occasioned if the nerve supply is but partly abolished.

Proponents of vagus resection attribute reports of variable and inconstant results after nerve division to an incomplete operation. They maintain that the lack of success which early surgeons experienced with vagus resection in the treatment of chronic peptic ulcer was the consequence of the inadequate procedures they employed. Hence, the importance of interrupting the vagi at the level of the esophageal hiatus is based on the belief that this approach is likely to be more thorough and the effects more constant. First performed clinically and popularized by Dragstedt and his colleagues in 1942, the modern operation was investigated earlier in the laboratory. Hartzell, in 1929, was among the first to observe and report the immediate effects of transthoracic vagus resection in dogs, and Vanzant, 2 years later, studied the late effects of this operation.

THE STOMACH

Secretion. Hartzell pointed out that the flow of gastric juice was strikingly diminished after vagus resection. Shay and his colleagues, working with rats, observed that the secretion was reduced by from 80 to 90 per cent. Ruffin and White examined patients with duodenal ulcer and found that nerve division decreased the volume and degree of acidity from 30 to 40 per cent. On the other hand,

in the individuals with gastric ulcer studied by Harper and Dragstedt, the secretory changes were generally minimal.

Extensive investigations by Thornton and his associates showed that a secretory response could be elicited with histamine or caffeine but not by sham-feeding or insulin-provoked hypoglycemia after vagus resection. Thomas and Komarov, Stein and Meyer, and others found that although the response to chemical stimulation persisted after operation, the volume of secretion and the degree of acidity were generally reduced.

Stein and Meyer also emphasized the point that gastric secretion, while inhibited during the interdigestive period, was not abolished in its entirety. Similarly, Winkelstein noted that nocturnal secretion was invariably lowered about 50 per cent by vagus resection alone, although achlorhydria seldom followed. Achlorhydria, however, did occur in 53 per cent of the cases when gastroenterostomy was also added and in 94 per cent when both the stomach and nerves were resected.

The insulin test has not proved to be entirely dependable as a method of ascertaining the completeness with which the vagus nerves are divided. Moreover, when a gastric shunt has been added the reflux of alkaline duodenal juices through the newly created stoma makes secretory determination more difficult and less accurate. Lahey, Smith, and their associates and Walters and his associates were among the first to recognize the unreliability of the insulin test. The latter group of authors found that symptomatic improvement occurred more often when the test was positive than when it was negative, and that acidity was reduced in 69 per cent of the group when the test was negative and in 93 per cent when it was positive. Moore and his associates observed that repeated tests on the same individual elicited varying responses. Hollander came to the conclusion that the insulin test was not specific for the vagi, but probably bore a relationship to all gastric secretory nerves. Hence, a positive test could be obtained even when all the vagal fibers were severed if "vagomimetic nerves of spinal origin" were present and active.

Wolf and Andrus observed that vagus resection eliminated the emotional response of the gastric mucosa as reflected by variation in its vascularity.

Motor activity. It has long been known through experimentation that pronounced motor changes follow as a consistent sequel to vagus resection; that is, decrease in tonus and motility, delay in gastric emptying, and spasm at either end of the stomach. These changes have also been observed clinically in recent years, having been the subject of extensive investigations by Moore and his associates, Machella and his associates, Ritvo and Shauffer, Grimson and his associates, Walters and his associates, and others.

Dragstedt and his associates, using the balloon technique, marshaled evidence to show that while tonus and the amplitude of hunger contractions decreased, the latter activity continued to be normal in duration. Most investigators found the pylorus to enter into spasm, a state which Churchill and Sweet observed following division of the vagi incidental to resection of the lower esophagus for carcinoma. Paulson and Gladsen, however, found the pylorus to be patulous and responsive on gastroscopic examination.

THE ACCESSORY ORGANS OF DIGESTION

Complete and convincing physiological investigations relative to the effects of vagus resection on the accessory organs of digestion have not been carried out either in the laboratory or clinically. What information is available, however, seems to indicate that comparatively few significant changes take place.

Small intestine. Cannon, in 1906, was the first to report that the motility of the dog's intestine is inhibited by vagus resection. This observation is in contrast to the earlier one of Pavlov and the later one of Alvarez and his associates who found that the gut of rabbits assumed a state of hyperirritability. Numerous clinical studies, noteworthy among which are those of Grimson and his associates, Ruffin and White, Machella and Lorber, Ritvo and Shauffer, and others, showed that the bowel displayed a tendency toward delay in transit time. Ritvo and Shauffer attributed this to the initial delay in gastric emptying. Collins and his associates found that roentgenologic motility studies in patients with diarrhea revealed the presence of hypermotility in all instances. Moore and his associates, however, concluded from kymographic studies that motor changes were transient, ill defined, and inconstant.

Bile. There is neither experimental nor clinical evidence to show that the production of bile is significantly modified by vagus interruption. The evacuation of bile from the gall bladder was found to be delayed in cats in which Johnson and Boyden had severed the right vagus nerve. Several investigators, among these Doubilet and Ivy, and Snape and associates, demonstrated that contraction of the denervated gall bladder in response to cholecystokinin remained unaltered. Recently, Snape observed that although the gall bladder still contracted forcibly when excitatory substances were placed within the duodenum, the

latent period was somewhat prolonged. Dragstedt and Camp, Moore and his associates, and others have concluded that no appreciable impairment in gall bladder function occurs clinically.

Pancreas. According to Crider and Thomas, division of the vagus nerves in dogs is invariably followed by complete cessation in the flow of pancreatic juice for 24 hours or longer. While external secretion can subsequently be stimulated by the instillation of acid, peptone, or both into the duodenum, the amount is decreased and the enzyme content, as measured by specific gravity and nitrogen concentration, is reduced 50 per cent. Pincus and his associates similarly observed that the nitrogen output from the pancreas of the dog in response to a meal was reduced, as a rule, from 60 to 80 per cent.

Collins and his associates, Orr and Johnson, and others maintained, after clinical observations, that the secretion of pancreatic juice was reduced following vagus resection. Collins and his colleagues related the development of diarrhea to this reduction. Most observers, however, contend that this assumption is not warranted from the data available.

The Pathogenesis of Chronic Peptic Ulcer

Efforts to explain the origin and chronicity of peptic ulcer continue to be conjectural and not altogether satisfactory even though this malady has been recognized for more than 150 years, and numerous theories relative to its cause have been proposed from time to time. The mucosal defect scarcely reflects the true state of affairs, but appears to represent merely the local manifestation of a widespread disorder. Moreover, evidence points to the fact that chronic peptic ulcer is probably not a disease of unitary origin but one which may be occasioned by a large variety of abnormal elements, inherited and acquired.

At present, prevailing opinion subscribes to the thesis that hydrochloric acid-pepsin proteolysis of vulnerable alimentary mucosa is the common denominator in the genesis of chronic peptic ulcer. The basis for this contention is sound experimentally as well as clinically. Mann and Williamson, and others have shown that acid gastric juice provokes the occurrence of an anastomotic ulcer when the alkaline duodenal secretions are diverted to the distal ileum or the exterior. A comparable situation is enacted when a gastroenterostomy is performed in the manner of Roux or is supplemented by a union of the afferent and efferent limbs of the anastomosis. In recent years Wangensteen and his colleagues devised a more physiologic method of producing peptic ulcer by stimulating the gastric secretory mechanism continuously and excessively through the injection of histamine implanted in beeswax. These are but a few of many reasons for emphasizing the importance of the acid-pepsin factor.

Although chronic peptic ulcer is virtually never encountered in the presence of true achlorhydria, it is also true that peptic ulcer does not develop frequently in persons with copious acid secretion. This fact necessarily implies that when ulceration does take place the mucosa has lost its ability to defend itself against the digestive action of the gastric juice. The manner in which mucosal integrity may be undermined in certain areas of predilection is not entirely clear although it seems probable that such deterioration may follow in the wake of various changes. Among these are: (1) the loss of intrinsic protective substances; (2) injury, such as coarse foods, allergy, infection, myospasm, vascular spasm, embolism, venous engorgement; and (3) absence of extrinsic protective mechanisms, as saliva, mucus, ingested food, regurgitated alkaline duodenal juices.

Although the corrosive action of hydrochloric acid and pepsin on susceptible mucosa doubtlessly constitutes the immediate mechanism in the development of ulcer, there is reason to suspect that, at least in many cases, an underlying systemic disorder conditions this effect and determines the intermittent recurrences so characteristic of chronic peptic ulcer. This ultimate motivating force is believed to be related to a neurogenic disturbance, perhaps in association with endocrine dysfunction on some occasions. More precisely, many observers contend that the basic difficulty arises from disruption of the reciprocal balance of the autonomic nervous system, parasympathetic overflow ensuing. This condition is believed to be precipitated by noxious influences acting on the vegetative centers in the diencephalon. Such factors as hypoglycemia, mineral imbalance, allergy, infection, alcohol, tobacco, and psychic and emotional upheavals in particular, are among those most prominently cited.

In any event, it is further suggested that the excessive parasympathetic impulses are relayed to the cranial autonomic stations in the midbrain and medulla and from here through the vagus nerves to the stomach. As a consequence, the gastric motor and secretory activities and blood flow are quickened, and if the threshold of resistance of the tissue is exceeded, a characteristic ulcer is likely to result.

The supposition that a relationship exists between peptic ulcer formation and derangement of the autonomic nervous system is not new. More

than 100 years ago Rokitansky, according to Vonderahe, made the following striking comment: "Perhaps the proximate cause [of peptic ulcer] may be looked for in diseased innervation of the stomach, owing to a morbid condition of the vagus and to extreme acidification of the gastric juice." Bockus noted that von Bergmann in 1913 also implicated the vegetative nervous system and suggested that cortical influences might be concerned. Cushing came to similar conclusions in a series of cases of acute gastroduodenal perforation subsequent to operation for intracranial tumor. Following his report in 1931, a wide interest was aroused in this country, and since then, and particularly of late, emphasis has been placed on the role cortical influences may play in the genesis of peptic ulcer. Some observers have gone so far as to suggest that individuals with chronic peptic ulcer tend to present a specific type of makeup—physical, emotional, and psychic.

As further proof of the psychosomatic etiology of peptic ulcer, reference is frequently made to the direct observations of Wolf and Wolff who, like Beaumont in 1825, found that a correlation existed between certain emotional disturbances and gastric overactivity. Dragstedt, Winkelstein, and others have also stressed the importance of the neurogenic factor. They have pointed out that individuals with chronic ulcer secrete during the interdigestive period, when theoretically the mucosa is most vulnerable, excessive quantities of juice bearing the same proteolytic characteristics (rich in pepsin as well as hydrochloric acid) as that produced during the cephalic (neurogenic) phase of gastric secretion.

On the other hand, it must be emphasized that these issues are highly controversial and that the problem still remains unsettled. While it is true that gastroduodenal perforations are occasionally encountered in conjunction with lesions and trauma in the vicinity of the hypothalamus, such complications are of the acute variety and have never been proved conclusively to bear a relationship to the development of chronic peptic ulcer. It is also true that a large percentage of duodenal ulcers are associated with hypersecretion and hyperacidity, but the inference that vagal hypertonus serves as the causative mechanism loses much of its meaning since this, in itself, fails to account for the normal or subnormal secretory values which invariably accompany gastric ulcers (Levin). Warren, Griswold, Boles, and numerous others contend that there is little evidence available to justify relegating the chemical (hormonal) mechanism of secretion to an unimportant and subsidiary role in the genesis of peptic ulcer.

In summary, it may be said that many aspects of the so-called psychosomatic theory are attractive. It would appear, however, that the origin of chronic peptic ulcer cannot be explained at all times in this manner. Additional factors are doubtlessly concerned.

Rationale of Vagus Resection in Chronic Peptic Ulcer

The basis for vagus resection rests on the premise that chronic peptic ulcer is a systemic disturbance, the underlying mechanism of which ultimately relates to parasympathetic overbalance. Hence, it is reasoned that division of the vagus fibers, by releasing the stomach from excitatory neurogenic influences, will curtail excessive secretory motor and vascular activities, the immediate cause of the ulcer. This would lead to rapid amelioration, facilitate healing, and prevent recurrences.

There are several reasons to challenge the validity of this concept and to keep in check any tendency toward overenthusiasm. For instance, division of the vagus nerves for chronic peptic ulcer was originally carried out by Exner in 1907, according to Alvarez, and while this operation enjoyed immense popularity in Europe for a short period, its performance became progressively more infrequent and by 1925 was almost entirely abandoned. This is attributed to incompleteness in the procedures used. This assumption, however, may not be warranted and perhaps other factors may have brought about the unsatisfactory results.

In the second place, if, as is believed, parasympathetic impulses are on some occasions conveyed to the stomach over pathways other than the right and left vagi, division of these trunks, no matter how thorough, will fail to secure the desired effects. Moreover, of even greater significance is the fact that gastric activities tend in time to return toward the normal level, whether this be the result of such an anatomical distribution, regeneration of the divided nerves, or some other obscure mechanism. It would appear that under these circumstances the benefits of vagus resection might be temporary.

Furthermore, interruption of the vagi could hardly be expected to promote healing of an ulcer of which the origin was unrelated to parasympathetic overflow. Thus, resection of the tenth cranial nerves has failed to prevent the histamine-provoked ulcer (Baronofsky and his associates), the Mann-Williamson ulcer (Saltzstein and his associates), or its clinical counterpart, jejunojejunostomy following gastroenterostomy (Drag-

stedt). Of course, it is true, as Dragstedt pointed out, that neither the absence of duodenal neutralization nor secretory stimulation of the degree that histamine-in-beeswax engenders is encountered with sufficient frequency, clinically, to be of practical significance in any but the rare case. However, the striking feature is that "nonneurogenic" secretion may provoke the formation of an ulcer. Nor is there proof that the stimulus must approximate the intensity attained with the use of histamine implanted in beeswax.

On the other hand, these criticisms are chiefly conjectural and may well be unfounded. In the last analysis, the effectiveness of vagus resection in the surgical treatment of peptic ulcer can best be determined by the clinical results this operation affords. In presenting these results an effort has been made to distinguish the cases in which vagus resection alone was performed from those in which a gastric drainage procedure was added. This was done to avoid any tendency toward erroneous interpretation and ambiguity. For the same reason duodenal, gastric, and jejunal ulcers have been considered separately. The results obtained from these procedures were then compared with those from partial gastrectomy and gastroenterostomy.

Clinical Results of Vagus Resection

Duodenal Ulcer

Long term results are not available and a final evaluation of vagus resection is admittedly impossible at this time. However, careful studies of the immediate and intermediate results have disclosed a good deal of information, and important conclusions can, therefore, be drawn.

Most investigations indicate that vagus resection alone, when carried out completely, is soon followed by impressive benefits. Usually, healing takes place within a matter of several days to a few weeks and, what is more noticeable to the patient, the pain associated with ulcer ceases rapidly and often in a dramatic fashion. Ruffin estimated that relief occurs in from 85 to 90 per cent of the cases. Healy likewise found that 77 per cent of his 40 patients were benefited clinically. Of 36 patients subjected to transthoracic vagus resection, Grimson and associates observed that 30 were completely relieved, whereas 6 occasionally experienced some mild ulcer distress. Walters and his associates reported that in their series of 15 patients who underwent transthoracic nerve division, ulcer pain was abolished in 9 completely and in 3 partially, while failure ensued in the remaining 3.

The mechanism responsible for the abatement of pain is not clear since, in fact, the cause itself of ulcer pain remains obscure and efforts to explain it have incited only a good deal of controversy. Kirsner, referring to the earlier work of Palmer and that more recent of Bonney and Pickering, maintained that the cessation of pain is related to a decrease in the acid concentration of the gastric juice. Dragstedt and his associates also stressed the importance of this factor although they implied that motility changes might be concerned. Ruffin and White, Grimson and his associates, and Smith and his associates investigated the problem, and from their studies concluded that the subsidence of ulcer distress is the direct consequence of peristaltic inhibition.

In any event, it seems rather certain that the relief which patients obtain is not due to the interruption of sensory fibers with ensuing gastric anesthesia. This opinion is borne out by the fact that painful stimuli applied to the stomach are still perceived after vagus resection. Nor does there appear to be a direct relationship between the termination of ulcer distress and healing of the lesion. As Bockus pointed out, the value of the operation is obviously lessened if ulcer activity persists.

Furthermore, while pain incident to peptic ulcer may be suppressed by vagus resection, Grimson and his associates, and Walters and his associates, among numerous others, emphasized the fact that ulcer pain is replaced, in a high percentage of instances, by distress incident to untoward postoperative sequelae. The first group of observers found this to be the situation in 25 of the 36 transthoracic vagus resections they performed. It is, of course, true that such discomfort is generally of mild intensity and short duration.

In spite of these many shortcomings, Dragstedt and Camp, in a followup study covering from 2.5 to 5.0 years, reported excellent results in 80 per cent of 56 patients with duodenal ulcer subjected to transthoracic vagus resection, and in 86 per cent of 88 in whom transabdominal vagus resection was done. Ruffin, basing his opinion on 100 personal cases (the survey being conducted by the American Gastroenterological Association) and other published reports, was similarly impressed with the effectiveness of this operation in from 85 to 90 per cent of the cases.

Other reports, however, indicate that vagus resection alone tends to be less satisfactory. Thus, while Gardner and Hart noted improvement in 80 per cent of their patients, 12 per cent of these required the addition of a drainage procedure. Smith and his associates likewise observed that complete recovery occurred in 42 of 50 patients who had undergone transthoracic nerve interrup-

tion, but in this series 9 had had a gastroenterostomy previously and 4 required one before the complications attending vagus resection were corrected. The results of Johns and Grose are also impressive, 82 per cent of their patients making a good clinical recovery. But in many of these, too, vagus resection had been supplemented by gastroenterostomy. The failures occurred principally when the latter procedure had not been added.

Moore found vagus resection to be distinctly beneficial in 84 per cent of 116 patients whom he observed over a period ranging from 5 to 45 months (99 with duodenal ulcer, of whom 4 required gastroenterostomy, and 17 with anastomotic ulcer, 11 of the ulcers having followed partial gastrectomy). He hastened to add, however, that it was his distinct impression that the majority of these patients were not "cured" but were simply being "managed" by avoiding "maximum ulcer producing pressure either of environment or diet." Recently Moore has come to the conclusion that even this benefit was of temporary duration.

Walters and Brownson reported that the outcome was unsatisfactory in 6 of 14 patients with duodenal ulcer for which vagus resection alone was carried out. Walters and his associates attributed their poor results to the extreme care they exercised in selecting cases of duodenal ulcer for operation. In their opinion, the effects of vagus resection were "inconstant, variable and, in most cases, unpredictable." Colp came to the same conclusion.

THE UNSATISFACTORY ASPECTS OF VAGUS RESECTION

Technical Difficulties. Vagus resection is admittedly an easier and safer operation than is partial gastrectomy. However, the isolation and division of the major vagus trunks and their filaments just proximal to the diaphragm frequently entail a procedure of no small proportion. Moore, in particular, disparaged the tendency to underestimate the technical magnitude involved in performing a complete nerve operation and warned that the simultaneous performance of vagus resection and other gastric surgery often proves to be imprudent and hazardous in average hands. On more than one occasion he has deemed it necessary to carry out gastroenterostomy through the abdomen and nerve interruption through the chest as separate procedures. It was Moore's opinion that when vagus resection alone was contemplated, it was best to perform it transthoracically, allowing it to stand on its merits.

Even though the vagus nerve filaments can undoubtedly be severed with greater ease and certainty through the chest, the transabdominal route is utilized most often, principally because it permits direct visualization of the ulcer and any other pathologic changes. Moreover, gastric drainage can be carried out simultaneously. Dragstedt and his associates, Moore and his associates, and Scott and Schilling, among others, stressed the importance of mobilizing the esophagus at the hiatus and exerting downward traction on it. This maneuver facilitates a more complete exposure of all independent nerve fibers. It is, of course, not new and was employed by Exner, many years earlier, for the same purpose. Crile guides a wire loop over the main nerve trunks into the mediastinum for the sake of thoroughness.

Procedures of this type are obviously not altogether devoid of risk. A case was recently reported to the authors of traumatic perforation into the lumen of the esophagus which occurred at the time of its mobilization. Crile reported a similar injury of the stomach, uneventful recovery ensuing after simple closure.

Mortality Incidence. The mortality incidence attending the performance of vagus resection alone is not known with certainty since the majority of reports include cases in which supplementary gastric drainage has also been performed; however, it appears to be extremely low. Dragstedt reported no deaths directly attributable to nerve interruption in a series of 300 transabdominal operations. On the other hand, Healy encountered a mortality rate of 2.1 per cent, and at the Mayo Clinic during 1947, according to Walters and his associates, the rate was 1.5 per cent in 65 cases. In many of the latter cases, however, the operation was supplemented by a shunting operation. According to the first report on the survey being conducted by the American Gastroenterological Association the mortality rate was found to be 1.7 per cent in well over 2,500 cases of peptic ulcer (1.5 per cent in 949 transthoracic and 1.8 per cent in 1,592 transabdominal vagus resections).

Persistence and recurrence of ulcer disease. Most observers agree that while the greater proportion of ulcers heal within a comparatively short time after vagus resection, some remain refractory and fail to disappear. Persistence of symptoms, as Scott and Schilling pointed out, does not, of course, signify that this is due solely to an unhealed, active lesion. Nor does the return of symptoms mean that recurrent ulceration has necessarily taken place.

Proponents of vagus resection maintain that improper healing is invariably the consequence of an incomplete operation. Walters and his associates, however, reported that, despite the cessation of ulcer pain, x-ray studies showed a per-

sistent defect in 4 of 10 patients with duodenal ulcer at the time of discharge from the hospital. Healy likewise demonstrated by roentgenographic means a high incidence of intractability (49 per cent in 39 cases of duodenal ulcer), notwithstanding presumptive evidence of a thorough operation.

In a short term follow-up report on their first 160 patients Dragstedt and his associates stated that, of the 3 per cent manifesting symptoms suggestive of persistence or recurrence of the ulcer, all showed secretory evidence of an incomplete operation. In Moore's early experience, symptoms of ulcer without x-ray evidence of a lesion recurred in 4 per cent, whereas a demonstrable although asymptomatic lesion was observed in 7 per cent. As indicated before, it was Moore's impression that these values would have been substantially higher had not a strict antiulcer regimen been enforced postoperatively. Walters and Brownson found that recurring symptoms of ulcer developed in 18.1 per cent of 77 patients who had had vagus resection alone or in conjunction with other gastric surgery. In 5 of these individuals the lesion was demonstrable in roentgenograms. One of the main factors which prompted Grimson to supplement vagus resection with gastroenterostomy was the high incidence of recurrence after vagus resection alone.

Complications. Not only may vagus resection exert little influence to promote healing but, on rare occasions, it may even fail to interrupt the progress of the disease and prevent the development of serious complications. Thus the acute perforation of a duodenal ulcer shortly after vagus resection (with or without gastric drainage) has been reported by Weeks and his associates, Walters and his associates, Crile, and others. Crile also encountered a fatality following operation from perforation of the esophagus.

It is generally recognized that one of the striking features relative to the beneficial effects of vagus resection is the infrequency of recurrent bleeding after operation. This is in distinct contrast to the experience with partial gastrectomy for hemorrhage. Thus Smith and his associates witnessed only 1 instance of recurrent hemorrhage in 50 transthoracic nerve resections, 25 of which were performed for repeated episodes of bleeding. In contrast, however, Grimson and his associates observed 4 such complications during a longer follow-up study of 36 cases of transthoracic vagus resection. Coller encountered the recurrence of massive hemorrhage after a substantial period in 2 patients in whom the ulcer was not removed. Local ligation of the bleeding point and vagus resection also proved to be ineffective in a case reported by Crile. Such experience certainly indicates that in hemorrhage the lesion should also be removed, if possible, when the vagi are interrupted.

Postoperative development of gastric ulcer. The development of gastric ulcer subsequent to vagus resection for duodenal ulcer has been reported on a number of occasions. The underlying provocative mechanism is not clear but would hardly seem to be in harmony with the current concept of the origin of ulcer. While the concern over a relationship between physiologic disturbances incident to vagus resection and the later occurrence of neoplasia appears at the moment to have little foundation, nevertheless this possibility cannot be dismissed altogether. In any event, whether the development of gastric ulceration is a forerunner of more tragic consequences time alone will disclose.

Warren cites an instance in which 2 gastric ulcers appeared after interruption of the vagi for duodenal ulcer. Dragstedt and Camp also encountered this complication on 2 occasions, once in a series of 56 transthoracic, and once in 88 transabdominal, nerve resections. Grimson and his associates relate the occurrence of a small asymptomatic gastric lesion 4 months after transthoracic vagus resection in 1 of 36 patients so treated. Healing was spontaneous and rapid, however.

The subsequent occurrence of gastric ulceration is apparently even more frequent when the initial lesion has been located in the stomach. Thus, recurrences were manifested in 3 of 6 patients followed up by Walters and Brownson, in 2 of the 4 patients followed up by Collins and Stevenson, and in 4 of the 7 observed by Grimson and his associates. Andrus also described this strange development in a stomach which had been advanced into the chest after the vagus innervation had been interrupted incidental to resection of the distal esophagus for carcinoma.

Untoward sequelae attributable to vagus resection itself. The frequency with which gastric retention develops after vagus resection constitutes the most formidable drawback of this operation. Perhaps this, more than any other factor, precipitated the abandonment of vagus resection alone by virtually everyone, including its most enthusiastic proponents. This disturbance, as indicated before, arises from an inhibition of the motor activities and tends to be especially pronounced, of course, when the lumen of the gastric outlet is compromised. Retention manifests itself shortly after operation by such symptoms as nausea, vomiting, odoriferous eructations, and epigastric fullness after meals. Occasionally, however, these complaints may be delayed in their appearance, as Scott and Schilling emphasized, until the lesion

cicatrizes and obstructs the pyloric canal. They encountered 3 such occurrences after 25 transthoracic vagus resections.

Acute gastric stasis was observed by Machella and Lorber in 9 of 10 patients, by Thorlakson in all but 2 of his patients (these proving later to have had an incomplete operation), and by Healy in 50 per cent of the series he followed up, as disclosed by symptoms or upon roentgenologic investigation. Walters and his associates reported troublesome motility disturbances in 40 per cent of their patients (some having had supplementary gastric drainage), and in 12 per cent the effects persisted after 9 months.

Gardner and Hart found evidence of retention in 36 per cent of 77 patients, it being so pronounced in one-third as to require a subsequent shunting operation. Grimson and his associates were also forced to reoperate on 13 of 36 patients subjected to transthoracic vagus resection. Dragstedt and Camp came to the conclusion that from 20 to 25 per cent of all nerve operations necessitated the addition of gastric drainage to obviate retention and other disagreeable sequelae. From January, 1943, to the middle of 1945 Dragstedt performed transthoracic vagus resections alone; from June, 1945 to July, 1946, gastroenterostomy was also carried out simultaneously. Then from July, 1946 to a recent period the latter procedure was not added routinely because of the fear of subsequent anastomotic ulceration but was reserved for the 20 to 25 per cent of cases in which it was mandatory. At present, Dragstedt has again returned to the routine performance of both procedures since he no longer harbors any concern relative to stomal ulcer.

Most observers agree that the incidence of gastric retention is decreased, especially when the pylorus is occluded even in part, if a gastrojejunal anastomosis has been performed previously or one is added when the vagi are severed. Nevertheless, it is important to keep in mind Moore's suggestion that the addition of gastric drainage may not prevent altogether the occurrence of this or other disagreeable complications. Thus, Collins and his associates observed that among 84 patients subjected to gastroenterostomy and vagus resection, vomiting developed in 17 and diarrhea in 30. Wilkinson and Sullivan also found that epigastric "fullness" after meals followed in almost 50 per cent of 60 individuals in whom both the stomach and the vagus nerves were resected. In contrast, only 34 per cent were so troubled when partial gastrectomy alone was carried out.

Moore attempted to prevent the development of unfavorable side effects by performing a so-called "partial vagus resection" in order to preserve parasympathetic innervation to the other abdominal viscera. The left vagus and the gastric branches of the right vagus nerve were divided but that portion of the right vagus nerve extending toward the celiac plexus was spared. His efforts, however, were not successful.

In the absence of pyloric stenosis, gastric retention, as a rule, sooner or later disappears spontaneously. Hence, when supportive measures are employed zealously during the interim, secondary operations are often unnecessary. Stein and associates emphasized the merit of keeping the stomach decompressed by nasogastric suction and withholding peroral alimentation for the first 5 days. Urecholine, the parasympathicomimetic drug recommended by Machella and associates to facilitate gastric emptying, has met with wide acclaim. Stein and his associates investigated the effectiveness of several choline esters and were impressed with both urecholine and doryl.

Diarrhea, second in importance only to gastric retention, has proved to be a serious shortcoming of vagus resection. This complication is usually precipitated when solid feeding is first resumed and, in most instances, disappears of its own accord after a mild, sustained, or intermittent course. Occasionally, however, it assumes serious proportions and persists for a prolonged period. Neither blood, mucus, nor pus appears in the stool.

Diarrhea was encountered by Ruffin and Smith in more than 40 per cent of the 30 patients whom they subjected to vagus resection, and Collins and his associates observed its occurrence in 30 of 84 cases in which gastroenterostomy was added to the nerve operation. Wilkinson and Sullivan found no appreciable difference in the frequency of its appearance whether partial gastrectomy was carried out alone or in conjunction with vagus resection. Persistent diarrhea with intestinal cramps proved to be a major complaint in 8 per cent of the 77 patients followed up by Gardner and Hart.

The mechanism behind the development of diarrhea after vagus resection is not at all clear even though the problem has been investigated rather extensively. Pincus and his associates concluded from their experimental studies on the function of the pancreas after vagus resection that diarrhea might be occasioned by pancreatic insufficiency. Collins and his associates reported that the stool frequently contained fatty acid crystals and neutral fats, thereby indicating a spruelike syndrome. They recommended the administration of pancreatic and crude liver extracts.

Other investigators, however, have been unable to corroborate these observations. Alvarez and

his associates, in an earlier study on rabbits, found that the bowel exhibited hyperirritability, and they later suggested that this factor along with, possibly, ensuing alterations in absorption and secretion provoked the occurrence of diarrhea. Numerous observers, however, found the small bowel to be atonic and the transit time to be increased, a disturbance which Machella and Lorber attributed to gastric atony.

Smith and his associates, and Boles, among others, reasoned that the diarrhea could not be attributed to a change in the flora of intestinal organisms because of achlorhydria since the administration of hydrochloric acid failed to exert any demonstrable benefit. Saltzstein and his associates observed a pronounced jejunitis in dogs after vagus resection and offered this as a possible explanation for the occurrence of diarrhea.

Scott and Schilling, as well as Griswold, related this disturbance to irritation from decomposed ingesta retained in the stomach and recommended the addition of gastric drainage. This opinion, however, as indicated above, is not shared by most observers.

Recurrent epigastric pain is among the problems occasionally encountered after vagus resection; one of the more vexing has been recurring episodes of severe abdominal colic. This difficulty, according to Cattell, was one of several reasons why the nerve operation was discontinued at the Lahey Clinic. Grimson and his associates encountered this complication on 10 occasions in a series of 104 cases of vagus resection with or without gastric drainage. Two of their cases were due to reverse intussusception of the jejunum, but in general the cause remains obscure. As a consequence, treatment has not been definitive or satisfactory.

Dysphagia is another disconcerting consequence of vagus resection which occurs occasionally. Invariably mild and transient in character, it manifests itself, as a rule, when solid foods are first ingested. Machella and Lorber observed this complication in 1 of 26 patients subjected to vagus resection and postulated that it was due to trauma incident to the stripping of the nerves from the esophagus. Ritvo and Shauffer also encountered it once in 33 cases, but were inclined to believe that the cause was related to a disorder of the inherent motor mechanism with ensuing cardiospasm. Thorlakson reported the development of dysphagia in 5 instances, dilatation being required in 1 of the patients. In the experience of Grimson and his associates, 21 of 56 patients recovering from division of the vagi complained of dysphagia.

Early reports by Weeks and his associates and Moore and his associates attributed a fatality to cardiac standstill presumably as a result of vagus resection. Sufficient data, however, have accumulated since then which tend to refute, rather conclusively, the contention that adverse effects may be evoked through a vagus reflex.

Little is known concerning the relationship, if any, existing between some of the adverse effects discussed and alterations in the function of related organs of digestion. In general, however, there is little to indicate that any immediate changes of a deleterious nature take place in these structures. Dragstedt and Camp found no evidence of remote trophic disturbances of the abdominal structures in 2 patients who died 1 and 2 years, respectively, after vagus resection.

Transiency of effects. While most observers acknowledge the ability of vagus resection to promote healing in the majority of instances, nevertheless doubt is expressed in many quarters as to the permanence of such benefit. This opinion is based on the observation that the inhibition of activities of the stomach which lead to healing tends to be of temporary duration. On the other hand, several reports have appeared indicating the relative permanency of the effects of the nerve operation, for while gastric functions do tend to recover they seldom progress to their preoperative levels. Time alone will resolve the issue unequivocally and determine whether concern is warranted.

Dragstedt and his associates found, in a study on secretory function (nocturnal secretion, total fasting hydrochloric acid output, and the response to the sham meal, or insulin hypoglycemia), that the secretion remained inhibited after vagus resection as long as the patients were followed up. Laboratory studies by Grimson and his associates on 104 patients in whom vagus resection, with or without gastric drainage, was carried out from 2 to 4 years previously, also indicated that the effects on the acidity of fasting secretions and on gastric motility usually persisted. However, in half of the patients examined, large amounts of free acid were contained in the gastric juice, a finding which was attributed to some chemical stimulus or intrinsic mechanism not related to the vagus nerves.

As further proof that functions mediated through the vagus nerves remain permanently inhibited after operation, Dragstedt presented compelling evidence that the vagi do not regenerate once they are divided. The vagus nerves of laboratory animals were severed; but even though the ends were then sutured, secretory activity could not be demonstrated after 2 years. Dragstedt also cited the 2 cases, referred to before, in which postmortem

examinations 1 and 2 years after operation failed to reveal any tendency toward union of the nerve ends. Moreover, he emphasized the fact that isolated pouches in dogs never become reinnervated.

Vanzant also reported in 1931 that the vagi in dogs which Hartzell had resected more than 2 years previously failed to show evidence of regeneration at autopsy. However, physiological studies demonstrated that the inhibited gastric functions had become reactivated. This observation has been corroborated clinically by Moore, Ruffin and White, Machella and Lorber, Ritvo and Shauffer, and numerous others, although most of these investigators stress the fact that the revived activities rarely attain their preoperative levels. Presumably the safeguard against recurrence of the ulcer resides in this quantitative disparity. Moore expressed the belief that such protection is in itself insufficient and, therefore, advised his patients to shun all ulcer-provoking excitations.

The mechanism responsible for the return of gastric functions is not at all clear. While Thomas maintains that the divided vagi tend to regenerate, most observers agree with Vanzant and Dragstedt that this seldom occurs. Both Moore and Hollander suggest that reactivation may be due to the transmission of parasympathetic impulses over pathways other than the vagi; Moore speaks of "cholinergic fibers in the splanchnics" and Hollander of "vagomimetic fibers of spinal origin."

Carcinogenesis. Notwithstanding the fact that the stomach has long been recognized as the most fertile site for the occurrence of carcinoma in the male, efforts to explain this predilection have not been altogether satisfactory. Nor is it certain whether the presence of achlorhydria or hypochlorhydria is the consequence of the cancer or whether, in fact, these physiologic alterations exert some influence on the development of the cancer. In any event, low gastric acidity is commonly encountered in conjunction with a mitotic lesion of the stomach. Hebbel and Gaviser found that nearly 90 per cent of all patients with gastric carcinoma fail to secrete more than 30 units of free hydrochloric acid even with the use of triple histamine stimulation. Moreover, achlorhydria has been detected on a number of occasions long before the cancer itself made its appearance. Wangensteen regards achlorhydria in a person past the age of 60 as a precursor of gastric carcinoma and recommends that all such persons be kept under vigilant roentgenologic scrutiny.

Unless the occurrence of gastric ulcer after nerve interruption is interpreted as a warning, there is admittedly no indication, to date, purporting to show a relationship between vagus resection and the subsequent development of gastric carcinoma. Nevertheless, it appears to us that the pronounced disturbances provoked by this operation may conceivably not be as innocuous from the standpoint of carcinogenesis as would seem to be the case at present. Time alone, of course, will furnish the answer to the possibility of this catastrophe.

GASTRIC ULCER

Few reports are available concerning the results of vagus resection in the treatment of gastric ulcer because such lesions are almost invariably subjected to partial gastrectomy. This preference is due to the fact that the latter operation provides unexcelled results and eliminates the hazard of overlooking an ulcer which may later prove to be malignant.

Nevertheless, Harper and Dragstedt maintained that vagus resection was indicated when removal of the lesion entailed undue risk (gastric ulcer located near the cardia), or when the presence of a malignant tumor could be excluded with reasonable certainty (less than 1 per cent of gastric ulcers prove to be malignant when a duodenal ulcer coexists). In attempting to explain why peptic ulcers of the stomach heal even though frequently the acid concentration of the gastric juice remains unaltered, Harper and Dragstedt postulated that factors other than peptic digestion alone were concerned in the genesis of a gastric ulcer.

What little experience others have had with vagus resection for gastric ulcer has not, in general, proved to be satisfactory. Collins and Stevenson reported that recurrence took place within the first year in 2 of 4 patients, both presumably mistaken instances of carcinoma. Walters and Brownson found that, in their series of 6 cases, a demonstrable gastric ulcer recurred in 2 patients, and symptoms without visualization of a lesion manifested themselves in another. In a series of 7 patients presented by Grimson and his associates symptoms of ulcer reappeared in 1, the presence of a recurrent lesion was demonstrated in another, 1 patient was unable to resume work completely, and 1 suffered massive hemorrhage requiring partial gastrectomy which, the authors claimed, also proved to be unsuccessful.

ANASTOMOTIC ULCER

According to the preliminary report on the survey conducted by the American Gastroenterological Association, 61 per cent of the 2,541 collected cases of vagus resection were performed for

anastomotic ulceration. This percentage, while high, is probably representative, although very few comprehensive studies have appeared in the literature relative to this aspect of the subject. The fact that anastomotic ulcers predominate is all the more remarkable when one considers the infrequency of this complication as compared with the incidence of peptic ulcer requiring operation. This preponderance, however, should not occasion surprise since the treatment of anastomotic ulcers, by measures other than division of the vagus nerves, has in general been notoriously hazardous and unsuccessful. Understandably then, the nerve operation has been employed almost exclusively in the presence of stomal ulcers ever since vagus resection was reintroduced.

From a theoretical point of view, this procedure, as Priestley emphasized, is the most rational of all surgical measures when an anastomotic ulcer follows extensive resection of the stomach, since not only is the gastric phase of secretion curtailed by the high resection but interruption of the vagi should eliminate the neural phase. The rationale is less sound when vagus resection is performed for marginal ulcer which develops after simple gastroenterostomy, for under such circumstances the gastric phase of secretion, of course, continues to function without inhibition.

In a follow-up study covering a brief period, Priestley and Gibson observed that vagus resection, with or without restorative surgery, was productive of satisfactory results in 19 of 20 cases of anastomotic ulcer secondary to simple gastroenterostomy and in 19 of 24 which followed partial gastrectomy. There were no deaths. In contrast, they found that the incidence of satisfactory results observed over a 5 to 10 year period was 87.4 per cent (103 cases of gastroenterostomy ulcers) and 50 per cent (11 cases of gastrectomy ulcers), respectively, with extensive gastric resection. The mortality rate attending partial gastrectomy for stomal ulcer following gastroenterostomy was 2.9 per cent (169 cases) and 7.4 per cent (27 cases), and for stomal ulcer after gastric resection it was 11.1 per cent (18 cases). Walters and Brownson reported a similar experience with vagus resection: excellent results in 8 of 10 cases of stomal ulcer after gastroenterostomy and in 22 of 25 cases of stomal ulcer after gastrectomy. Moreover, a good result was obtained in all 4 cases of gastrojejunocolic fistula in which either a new stoma was created or the normal anatomy was restored in addition to interruption of the vagi.

Healy was less impressed with vagus resection in a short term follow-up study on 7 patients because 4 of these showed roentgenoscopic evidence of recurrence or persistence of the lesion. Grimson and his associates emphasized the fact that healing of the stomal ulcer, which is usually prompt after a nerve operation, may be delayed for a considerable period. Their results were also less striking. Thus, of 10 patients in whom a stomal ulcer developed after gastroenterostomy, only 5 were completely satisfied after vagus resection, and, of these, 3 experienced colicky pain intermittently; 4 were only moderately satisfied, 2 being troubled with diarrhea; and 1 was totally dissatisfied and died later. Of 9 patients with gastrectomy ulcers, 5 were entirely relieved after vagus resection but 3 suffered from diarrhea and 1 from colic. Thorlakson, and Faxon and Schoch encountered massive bleeding after vagus resection for gastrojejunocolic fistula, the former having carried out this operation alone as a preliminary procedure, the latter surgeons having also restored the anatomy of the gastrointestinal tract.

Results of Vagus Resection Supplemented by Gastric Drainage

As was indicated before, the present trend of combining the nerve operation with gastric drainage was motivated not by the failure of vagus resection to promote healing, but rather by the frequency with which untoward sequelae developed after operation. The distinct improvement which followed this change in treatment has been emphasized to substantiate the merit of this combination. However, the immediate results of vagus resection when combined with a gastric shunt may be misleading since the latter procedure has, in itself, proved to be an eminently satisfactory, though at times temporary, method of dealing with peptic ulcer. Furthermore, emphasis should be placed on the fact that a considerable period of well-being often intervenes before serious complications directly attributable to the shunt manifest themselves. Thus Trimble and Reeves observed that in excess of 90 per cent of patients with peptic ulcer upon whom a posterior gastroenterostomy or pyloroplasty had been performed were benefited and well after a period of as long as 10 years.

Collins and his associates found that in 89 per cent of 84 cases in which vagus resection was combined with gastric drainage, an excellent or satisfactory result was attained, diet or drugs being no longer required. Furthermore, in none of their failures was there roentgenographic evidence of recurrence. They came to the conclusion that the joint performance of vagus resection and gastroenterostomy was more effective than was gastroenterostomy alone. Sanders reported excellent

results in over 90 per cent of 32 patients in whom both surgical procedures were carried out simultaneously. Scott and Schilling were also impressed with the achievements of the combined operation, but preferred the Finney-Haberer pyloroplasty to gastroenterostomy, contending that the former was physiologically more sound.

The experience of Grimson and his associates similarly led them to believe that the addition of gastric drainage was productive of a higher incidence of success than was the case when only the vagi were resected. Thus all of 28 patients who were subjected to drainage as well as the nerve operation were completely relieved from discomforts and restrictions formerly associated with peptic ulcer. However, while 21 were completely satisfied, 7 were only moderately so and were capable only of part time work. Minor discomforts appeared occasionally, and 12 were unable to regain their normal weight. Johns and Grose also found the combined operation to be superior to vagus resection alone, and in a later report commented that either operation assured a more satisfactory outcome in general than did partial gastrectomy. Their deductions were based on such clinical criteria as ability to eat regular meals, gain in weight, absence of the "dumping syndrome," and return to work.

In a survey covering a 2.5 year period, Crile reported the results of 2 comparable series of 50 ulcer cases, the patients in one having been subjected to extensive partial gastrectomy and those in the other to either vagus resection alone (13 patients) or to the combined operation (37 patients). In the first group, 58 per cent obtained an excellent result, 29 per cent were benefited, and 13 per cent were not benefited. In the second group the results were more striking—excellent in 88 per cent, beneficial in 10 per cent, and without benefit in 2 per cent, this patient subsequently responding to the addition of a gastroenterostomy. Crile was disinclined to ascribe the striking difference to the performance of gastroenterostomy since, in his opinion, gastroenterostomy alone was associated with a greater morbidity incidence and a higher recurrence rate than was partial gastrectomy.

On the other hand, Walters and Brownson emphasized the point that observations were too recent to permit an accurate appraisal relative to the incidence of recurrence, and maintained that the immediate results with the combined operation seemed to be little better than with gastroenterostomy alone. Of 67 patients having the combined operation, 59 were completely relieved, whereas 8 were troubled with motility disturbances, presumably of rare occurrence after gastroenterostomy alone. In 1 patient an anastomotic ulcer developed, although it must be pointed out that an enteroanastomosis had also been performed.

UNSATISFACTORY ASPECTS OF VAGUS RESECTION AND GASTRIC DRAINAGE

The combined operation is, of course, subject not only to the technical difficulties which may attend division of the vagus nerves (see previous pages) but to those which occasionally characterize the performance of an alimentary anastomosis. Moore emphasized the fact that the risk tends to be increased when both procedures are carried out at once, and on more than one occasion he deemed it advisable to perform gastroenterostomy through the abdomen and interruption of the vagi through the chest, separately. Nevertheless, the mortality rate incident to this operation is in general minimal, that reported by Crile probably being representative, 1.8 per cent in 228 cases.

While it is true that the tendency toward the development of gastric stasis is less when vagus resection is augmented by a shunting procedure, this complication, as Grimson recently pointed out, is not always eliminated. Nor does gastric drainage seem to exert much influence on the prevention of the other annoying consequences of vagus resection. Thus, among 84 cases reported by Collins and his associates vomiting appeared in 17 and diarrhea in 30 after operation. Moreover, the addition of gastroenterostomy invites the untoward sequelae to which this operation may give rise, for example, dumping and hypoglycemic syndromes, and stomal loop obstruction. In fact, at one time Dragstedt and Camp cited these difficulties in defense of their contention that the routine performance of supplementary drainage was imprudent. They also drew the inference that the hazard of anastomotic ulceration would be increased since, in average hands, from 5 to 10 per cent of nerve operations were incompletely performed.

In the final analysis, the crux of the problem lies in the question of recurrent or anastomotic ulceration, since by the frequency of this serious mishap will be determined the ultimate fate of the combined operation. Lillehei, of Wangensteen's clinic, maintained that gastric drainage compromises the mechanism whereby vagus resection exerts its beneficial influence; that is, the retained ingesta buffer the acid gastric juice. However, studies on the postoperative secretion by Walters and Brownson and by Winkelstein

demonstrated that the reduction of gastric acidity and the development of relative achlorhydria were observed more often after the combined operation than after vagus resection alone. These findings are of utmost significance if the premise is valid that acid is the common denominator in ulcer genesis.

Relatively short term follow-up studies were encouraging in this regard. Dragstedt encountered only 2 stomal ulcers in 168 cases and in both of these the duodenal juice had been diverted through an enteroanastomosis between the afferent and efferent limbs. Crile also attested to the rarity of this complication in patients observed over a 2.5 year period.

Leaving to one side the controversial issue as to the transient effectiveness of vagus resection, it is well to point out that when anastomotic ulcers develop subsequent to gastroenterostomy alone, the majority manifest themselves within a short period. Renshaw and Beck found that such complications usually appeared within the first year after gastroenterostomy, and Allen and Welch reported that one-third occurred within the first year and two-thirds within 2 years. In a study of 283 patients with jejunal ulcer, Priestley and Gibson observed that in 56 per cent symptoms developed within 2 years; those following gastroenterostomy appeared on an average of 3.7 years, while these following partial gastrectomy for duodenal ulcer averaged 1.7 years. This observation seems to imply that vagus resection exerts a protective influence on gastroenterostomy against the development of anastomotic ulceration. The striking manner in which stomal ulcers are benefited by vagus resection suggested to Palmer that this complication was likely to be an infrequent sequela of the combined operation. This problem can be settled, of course, only by a longer period of observation.

Results of Vagus Resection and Partial Gastrectomy

Resection of both the stomach and the vagus nerves has not been performed frequently even though this operation appears theoretically to be more rational than either procedure alone. This supposition is based on the grounds that the removal of all the neural and most of the chemical phase of secretion offers the greatest likelihood of cure. The importance of the acid factor in the development of anastomotic ulcerations is emphasized by its occurrence, after extensive gastric resection, only when a high degree of acidity persists. Thus, high acid values and subsequent stomal ulcers are almost never observed after partial gastrectomy for gastric ulcer, but the reverse is rather often the case when the primary ulcer is located in the duodenum. Since there is reason to believe that the neural mechanism is responsible, at least to a large degree, for the continued secretion of excessive acid-pepsin juice after partial gastrectomy, it would seem logical to resect both the stomach and the nerves in persons with duodenal ulcer and high preoperative acid values.

According to Alvarez, experimental investigations by Wilhelmj and his associates showed that the decrease in gastric acids was more pronounced after resection of the stomach and vagi than after gastric resection alone. Moreover, they found the intestinal phase of secretion to be accentuated and prolonged after this combined type of operation. Winkelstein stated that, in 1922, Lorenz and Schur conceived the idea of sectioning the vagi when free acid persisted and symptoms recurred after partial gastrectomy. He stated further that Berg was the first to carry out both procedures as a prophylactic measure in 1927 and 1928 on 10 selected patients with duodenal ulcer and with very high free acids. Only the left vagus nerve, however, was resected. Studies on secretion by Winkelstein and Berg on 34 patients with duodenal ulcer in whom this method was used and on 59 patients in whom the stomach alone was resected showed that achlorhydria developed in 75 per cent of the first group whereas free acid persisted in 85 per cent of the second group.

In a more recent communication Winkelstein reported that resection of the stomach and both vagi led to nocturnal achlorhydria in 75 per cent of the patients as compared to 53 per cent when the operation consisted of vagus resection and gastroenterostomy. When only the vagi were resected nocturnal achlorhydria did not develop in any although a substantial decrease in degree and amount of acidity occurred in all. Similar results were obtained by Colp who, too, concluded that resection of the stomach and vagus nerves offered individuals with duodenal ulcer and high acids the maximal protection against recurrences. Colp also suggested that the addition of the nerve operation might lower the incidence of the dumping syndrome secondary to partial gastrectomy.

However, the immediate clinical results of this combined operation, as reported by Wilkinson and Sullivan, have proved to be unsatisfactory at the Lahey Clinic. In comparing 60 cases of duodenal ulcer in which both procedures were carried out with 60 cases in which only partial gastrectomy was performed, the following differences were noted: disagreeable postoperative symptoms

of greater or lesser extent were experienced in 42 per cent of patients in the first group as against 28 per cent in the second group; recurrent ulcer developed in 2 (neither associated with hemorrhage) as against 3 (1 with massive hemorrhage); and variable gastrointestinal atony was present during the initial 14 to 18 days with epigastric fullness in 50 per cent as against 34 per cent. Diarrhea occurred in both groups with equal frequency. The result was considered entirely satisfactory by 84 per cent of the first group of individuals and by 93 per cent of those having undergone partial gastrectomy alone. Moreover, severe intermittent abdominal colic of unexplained origin proved occasionally to be a troublesome complication in those in whom vagus resection was added. It was because of these untoward complications, Cattell reported, that the Lahey Clinic abandoned the practice of supplementing partial gastrectomy with vagus resection. Coller expressed the opinion that the addition of the latter procedure was unnecessary in view of the effectiveness of partial gastrectomy alone.

Paulson and Gladsen were unfavorably impressed by the roentgenoscopic and gastroscopic appearance of the residual stomach pouch after resection of both the stomach and nerves, there being pronounced mucosal disturbances which tended to persist. They found these changes to be less marked after gastroenterostomy and vagus resection, and minimal or absent when only the vagi had been interrupted.

Results of Partial Gastrectomy

Although vagus resection, either alone or in conjunction with other gastric procedures, leaves much to be desired in the surgical treatment of peptic ulcer, it must be emphasized that partial gastrectomy, the most frequently employed method in current use, is also associated with certain limitations and undesirable sequelae. Hence, a brief consideration of the results derived from the latter operation is essential for purposes of comparison. Only in this manner is it possible to reach an impartial decision as to the role which vagus resection is to play in the surgical management of ulcer.

DUODENAL ULCER

Considerable disagreement exists relative to the effectiveness of gastric resection in chronic duodenal ulcer. Of the many reasons for this, one of the more important is found in the striking discrepancies observed when attempts are made to define the criteria which must be fulfilled for a resection to be adequate. It has become increasingly clear, however, that more favorable results are being achieved since the technique of gastric resection has become more precisely standardized and certain other requirements are being more rigidly enforced.

In a study based on the late results of partial gastrectomy for duodenal ulcer in 1,290 patients, Allen and Welch found that 87 per cent obtained excellent or good results, 6 per cent were benefited, and 7 per cent presented failures. Wangensteen's experience (231 cases of partial gastrectomy for duodenal ulcer), as reported by Gaviser, was likewise highly successful: an excellent or good outcome in approximately 82 per cent and a satisfactory one in 15 per cent. These results are very similar to those of Walters and his associates, who in studying 197 patients observed that 83.5 per cent were well without any limitations and 14 per cent were well on dietary restrictions. Miller's findings were more notable: 90 per cent of 230 patients were considered cured and 10 per cent benefited. However, the results presented by Crile were not so imposing: an excellent result in 58 per cent, benefit in 29 per cent, and failure in 13 per cent.

UNSATISFACTORY ASPECTS OF PARTIAL GASTRECTOMY

Technical difficulties. Gastric resection is admittedly a formidable operation and one which is apt to be hazardous in the hands of the inexperienced surgeon, particularly when performed for duodenal ulcer. This fact is due mainly to the difficulty entailed in freeing a sufficient segment of tissue to effect a successful closure of the duodenal stump. Allen reported that this problem was encountered in approximately 25 per cent of all patients with duodenal ulcer subjected to resection. Several modifications have been devised to meet this challenge, one of the most satisfactory consisting of division of the stomach proximal to the pylorus and closure of the antrum after exenteration of the mucosa. Gaviser observed that in 55 patients in whom this maneuver was carried out the results were very similar to those which followed an uncompromised resection, being excellent or good in 80 per cent and showing improvement in the condition in 18 per cent.

The removal of adherent ulcers located distal to the duodenal cap and, specifically, those in close proximity to the papilla of Vater is similarly fraught with extreme risk. Several surgeons of wide experience, among them Lahey, Hinton, and Lewisohn, have maintained that the lesion must be removed if the greatest benefit is to be derived from partial gastrectomy. However, Wangensteen, Colp, Steinberg, Rienhoff, and others have

been equally insistent that such ulcers could be disregarded if an otherwise adequate resection was performed. Results, in general, seem to substantiate the latter contention.

Mortality incidence. The mortality rate attending partial gastrectomy is, of course, influenced by multiple factors and has been variously reported from under 1 per cent to in excess of 20 per cent. In competent hands and in instances in which the final decision relative to the safety of embarking upon a resection is suspended until the abdomen has been opened, an exceedingly low mortality incidence may be anticipated. Thus, Walters and his associates reported a mortality rate of 0.9 per cent in 317 cases of duodenal ulcer in which partial gastrectomy was performed at the Mayo Clinic during 1947. In the same period 55 patients were subjected to gastroenterostomy with a mortality rate of 3.6 per cent. This difference obviously arises from the fact that the latter is reserved for those in whom the risk is greatest.

In 416 unselected cases of gastric resection, Gaviser reported a mortality rate of 4.5 per cent for the entire group and one of 3 per cent when emergency resections were excluded. These are comparable to the figures presented by Allen and Welch; that is, 5.1 per cent and 2.5 per cent, respectively. Miller found the mortality rate after elective surgery to be 2.8 per cent in 230 cases, and in Rienhoff's series it approximated 2 per cent. It must be re-emphasized, however, that these exceptionally low rates are not representative and the mortality rate is, in general, higher.

Anastomotic ulceration. The relationship between the persistence of acid secretion and the subsequent occurrence of anastomotic ulcers has been the prime consideration throughout the evolution of partial gastrectomy as an operation to deal with peptic ulcer. Experience has shown rather convincingly that achlorhydria cannot be obtained with any degree of regularity unless at least three-fourths of the stomach, including the hormonal segment (antral mucosa) and the major portion of the lesser curvature, are removed.

Although the attainment of these desiderata has been generally effective in preventing anastomotic ulceration in instances of gastric ulcer and duodenal ulcer in patients with normal preoperative acid values, this has not always proved to be the case in patients with duodenal ulcer and an excessive degree of acidity. Nor is this fact surprising since neither the neural nor the intestinal phase of secretion is depressed. Moreover, all of the secretory mucosa is not excised.

In pointing out the need for additional safeguards, Wangensteen emphasized the importance of utilizing a short afferent loop in the anastomosis. This, he maintained, facilitates the formation of secretin and, therefore, the production of alkaline pancreatic juice, an extremely effective agent in guarding the stoma against proteolysis. Moreover, attention was directed to the progressive increase in vulnerability of the bowel distalward. Merendino demonstrated in laboratory animals that short loops resisted the ulcerating effect of histamine in beeswax better than did long loops. Clinically, there is much to recommend Wangensteen's contention. Thus, Gaviser found that achlorhydria developed in 85.6 per cent of all patients with duodenal ulcer subjected to a gastric resection meeting the requirements outlined, whereas Winkelstein reported the occurrence of achlorhydria in only 55 per cent following a long loop resection. Lannin likewise attributed the difference in the incidence of postgastrectomy stomal ulcer at the Lahey Clinic (11.4 per cent—Kiefer) and at the University of Minnesota (1.1 per cent—Gaviser) principally to the long afferent loop employed at the former clinic since the resections were otherwise very similar. In a study comprising 107 patients with anastomotic ulcer, Steinberg pointed out that none had had an adequate resection as measured by Wangensteen's criteria.

Perhaps this inadequacy of resection may help to explain the marked discrepancies reported relative to the incidence of postgastrectomy stomal ulcer; for example, Berg, 1.1 per cent; Walters and his associates, 2.5 per cent; Lewisohn, 6 per cent; McClure and Fallis, 4 per cent demonstrable and 4 per cent suspected; and Sanders, 8 per cent. Rienhoff encountered postoperative hemorrhage in approximately 10 per cent of his patients while Lahey stated that bleeding recurred in more than 25 per cent of those patients in whom partial gastrectomy was performed for bleeding. In 283 cases of jejunal ulcer, Priestley and Gibson observed that only 6.8 per cent followed gastric resection.

Gastric retention. Although acute gastric retention does not develop as often after partial gastrectomy as it does following vagus resection, a survey of the literature shows a higher incidence than is generally appreciated. Strauss and his associates encountered this complication following 18 of 221 partial gastrectomies, and more recently, Gardner and Hart stated that it had occurred following 14 per cent of their series of 123 gastric resections. McKittrick and his associates reported that at the Massachusetts General Hospital 17 instances of nonfatal malfunctioning stomas were observed between 1936 and 1941 following a series of 124 partial gastrectomies for

duodenal ulcer, and that between 1941 and 1944 this problem arose in 7 of 94 cases.

At the same institution Allen and Welch found that, between 1931 and 1940, secondary operation was required in 8 of 151 cases of partial gastrectomy for acute gastric retention. This high incidence prompted these authors to add transjejunogastric drainage routinely to gastric resection, a practice which, they later reported, eliminated entirely the need of a secondary operation for malfunctioning stomas. According to Marshall and Kiefer, the retrocolic anastomosis was abandoned at the Lahey Clinic largely in an effort to combat the high incidence of this distressing complication.

Further evidence of the frequency of acute postoperative gastric retention is gained from the imposing list of its possible causes. Among those prominently mentioned in the past were: improper size, site, or direction of the stoma; herniation of the gut through a rent in the mesocolon or between or behind the anastomotic loops; compression by the distended transverse colon; tissue edema; redundant mucosal folds; and spasm. More recently a good deal of emphasis has been placed by Ravdin and his associates on the factor of edema incident to hypoproteinemia. Serum determinations by Chauncey and Gray, however, failed to confirm this contention. Trimble and Reeves emphasized the factor of edema when, in a retrocolic anastomosis, the edges of the rent in the mesocolon were not secured high on the stomach or were anchored to the jejunal loops rather than to the stomach. Colp and Druckerman, on the other hand, related most of their cases to gastric atony resulting from traumatic injury to the vagus nerves or to the residual pouch. Wangensteen maintained that overinversion of the tissue was the principal source of obstruction at the efferent stoma, and, with Lynn and Hay, stressed the hazard of kinking at the afferent angle in the creation of a closed duodenal loop.

In any event, acute retention may be occasioned by a large variety of conditions, many of which disappear spontaneously while others require additional surgical treatment. However, since the provocative mechanism cannot, as a rule, be identified precisely, the management of this complication frequently proves to be vexing. Whether to adopt a policy of "watchful waiting" or to reoperate upon an already seriously ill person poses a difficult problem.

Nor is there general agreement as to the length of time surgical intervention may safely be delayed. Graham reported an instance in which nonoperative treatment was carried out for 43 days, when the obstruction disappeared. Lahey also witnessed a spontaneous cure after 16 days. Allen came to the conclusion that procrastination beyond 10 days in people over 50 years led to an increased mortality rate, exceeding 50 per cent.

Secondary operations are especially prone to be troublesome from a technical standpoint when the resection has been extensive and a short loop retrocolic anastomosis has been employed. Gastrojejunotomy (Hoag and Saunders) or efferent loop jejunotomy alone (Lynn) has been found, under such circumstances, to facilitate matters. As may be anticipated, additional operative treatment has been attended in the past by an extremely high mortality rate. Perman reported an incidence exceeding 50 per cent and Hoag and Saunders estimated that, in general, probably 75 per cent of the patients failed to survive a secondary operation. Understandably then, many surgeons feel obliged to supplement gastric resection with such drainage procedures as jejunostomy, transgastrojejunostomy, or transjejunogastrostomy.

Disturbances of a nutritional, metabolic, and mechanical character. Extensive resection of the stomach is generally conceded to impose distinct limitations on the patient as regards his diet. He is required to eat small quantities at frequent intervals in order to avoid the discomfort of epigastric fullness. In the majority of instances, however, the need for such restriction tends, for the most part, to disappear in time. Curiously, a large percentage of patients develop an intolerance to milk. The explanation for this is not clear, although Gaviser reported that investigative studies suggested a psychogenic basis. Most patients regain their stamina rapidly and are able to resume normal activities despite an inability to gain weight. Secondary anemia may be encountered subsequent to operation but this is the exception, nor does there appear to be any relationship between partial gastrectomy and the development of primary anemia.

One of the most unmistakable complaints some patients register against partial gastrectomy relates to the occurrence of a chain of disagreeable symptoms after meals. Popularly known as the "dumping syndrome," it is believed by Eusterman and others to be due to the rapid distention of the jejunum when it appears immediately after eating or to hypoglycemia when the onset is delayed.

This disturbance was encountered in 7 per cent of the 230 patients undergoing partial gastrectomy as reported by Miller and in 5.6 per cent of the 500 observed by Custer and his associates. In Gaviser's series of 416 resections it occurred in only 2.6 per cent; on no occasion was it severe, and in all but 1 patient it was readily controlled by

dietary readjustments. Allen and Welch likewise found that postgastrectomy motor symptoms appeared in 2.3 per cent of their patients. In the opinions of Marshall and Lahey, Graham, Wangensteen, and others, the incidence of the dumping syndrome tends to lessen when only a portion of the divided end of the stomach is joined to the jejunum (Hofmeister anastomosis).

GASTRIC ULCER

Partial gastrectomy has proved to be so successful in the treatment of gastric ulcer as to raise the question of the wisdom of substituting other procedures in any but the rare instance, because of 4 considerations in particular: (1) the hazard of overlooking a malignant tumor is eliminated; (2) symptomatic results are highly satisfactory; (3) anastomotic ulcers rarely ensue; and (4) the lesion, with few exceptions, lends itself readily to partial gastrectomy which can, therefore, be performed with minimal risk of a fatality.

All students of the subject recognize the frequency with which benign and malignant ulcers of the stomach are confused and the need for microscopic study to resolve the issue in most of these cases. Notwithstanding the available diagnostic skill, Allen and Welch observed, in a survey covering a 10 year period, that 14 per cent of the patients treated at the Massachusetts General Hospital for benign ulcer had cancer. In a later report this error was found to have been reduced to 10 per cent, a figure which is identical with the one reported by Ransom and by Judd and Priestley. In a study comprising 131 cases of gastric ulcer, Marshall and Welch found that 26 later proved to be malignant, a diagnostic error of 19.8 per cent. This is representative of experience at large. Hence, anything less than radical extirpation of the lesion, when surgery is deemed necessary, is seldom to be condoned.

Individuals with gastric ulcer do unusually well after partial gastrectomy and are seldom disturbed by untoward sequelae. In a follow-up study covering a 5.5 year period Gaviser found that the results of 72 resections performed for gastric ulcer by Wangensteen and his associates were excellent or good in 76 per cent, satisfactory in 21 per cent, and poor in 2.7 per cent. These results are quite similar to those observed by Marshall and Welch. According to the estimates of Welch and Allen, 75 per cent of the patients became asymptomatic postoperatively, 15 per cent continued to have trivial complaints which were readily controlled by diet, and 10 per cent required medical attention for relief. Walters was even more impressed, believing the results to be very nearly perfect. Earlier, he and Clagett reported 1 poor result in a series of 162 resections for gastric ulcer.

Furthermore, anastomotic ulcers are rarely encountered after partial gastrectomy for gastric ulcer. In fact, such complications seldom occur after gastric surgery, irrespective of the type. Thus, in a study of 283 cases of jejunal ulcer, Priestley and Gibson found that the antecedent lesion had been a duodenal ulcer in 92.5 per cent and a gastric ulcer in only 1.4 per cent, identification being impossible in the remaining 5.3 per cent. In the experience of Winkelstein, achlorhydria appeared in virtually all instances after the extensive removal of gastric mucosa. Gaviser also reported a high incidence of postoperative achlorhydria (88%); in none of the patients in his series of 72 had an anastomotic ulcer developed.

Finally, because closure of the duodenal stump seldom entails much of a technical problem, partial gastrectomy may be performed with dispatch and with a respectable mortality rate. Thus, Walters and his associates reported a mortality incidence of 0.9 per cent in 116 cases of partial gastrectomy at the Mayo Clinic during 1947. A low rate has likewise been reported by several others, including Welch and Allen (2.2 per cent) and Marshall and Welch (no deaths in a series of 96 consecutive resections over a 9 year period).

Recently a good deal of emphasis has been placed on the technical difficulties attending the removal of ulcers situated high on the lesser curvature. According to Welch and Allen, approximately 10 per cent of all gastric ulcers appear to be located in this vicinity. It is true, however, as Marshall and Welch pointed out, that many of these have been distorted by inflammatory changes and can be resected without undue difficulty once the lesser curvature is mobilized. For the remainder it becomes necessary to employ other procedures, none of which is without serious limitations.

Total gastrectomy hardly appears merited for benign ulcer except in special cases, chiefly because of the attendant high mortality rate. It is true that the risk has been substantially reduced of late. Thus, Longmire encountered only 2 deaths in 20 total gastric resections and, in a more recent analysis of the Johns Hopkins Hospital series of 63 cases, Scott found the mortality incidence to be 9.5 per cent. Similarly, Walters and his associates reported that but 1 death occurred in 19 total gastrectomies performed at the Mayo Clinic during 1947. Nevertheless, it must be pointed out that such success is indeed singular and has not, in general, been duplicated. Moreover, survivors of such extensive surgery are often left with crippling sequelae. It is for these reasons

that Ransom suggested, as had Harper and Dragstedt originally, that a tempting solution to the problem was a trial of vagus resection, to be followed later by total gastrectomy if healing of the ulcer fails to take place.

Welch and Allen's interest in transthoracic resection of the proximal stomach and vagi with restoration of continuity by esophagogastric anastomosis would hardly seem to be practical at the present time for benign ulcer. In their brief experience, a mortality rate of 21 per cent was encountered, and of 10 patients followed up for a short period, 4 were well, 4 had mild complaints, and 2 complained severely. The operation of Madlener, consisting of partial gastrectomy distal to the lesion and popularized recently by Colp and Druckerman, loses much of its value principally because it fails to settle the question of malignancy. Moreover, healing of the ulcer does not always follow.

ANASTOMOTIC ULCER

Few detailed studies are available concerning the immediate and late results of partial gastrectomy in the management of anastomotic ulcer. The most informative is the report by Priestley and Gibson on 283 patients subjected to operation between 1937 and 1942. They found that in 196 cases of stomal ulcer developing after gastroenterostomy, partial gastrectomy was associated with a mortality rate of 2.9 per cent when a posterior Polya modification was employed (169 cases), and one of 7.4 per cent when one of the other anastomoses was utilized (27 cases). Five to 10 year follow up observations on 103 of these patients showed that 87.4 per cent had obtained a satisfactory result.

On the other hand, partial gastrectomy proved to be of less value for stomal ulcers developing after gastric resection. In 18 such instances the operative mortality rate exceeded 11 per cent, and in a long-term follow up on 11 patients only 50 per cent were found to have been benefited.

According to Walters and his associates, partial gastrectomy was performed on 45 patients with jejunal ulcer at the Mayo Clinic during 1946 with but 1 death, an incidence of 2.2 per cent.

Results of Gastroenterostomy

Gastroenterostomy is now generally regarded as an unsatisfactory operation in the management of chronic peptic ulcer in all but the unusual instance. This was not the case in the past as gastroenterostomy enjoyed singular favor for a long time. In a measure this was due to the fact that indications for surgical intervention were less exacting in cases of duodenal ulcer than they are at present. On numerous occasions operations were performed when, according to present standards, medical treatment would have been sufficient for relief. Understandably then, successful results were easily obtained surgically. Moreover, the confusion was further heightened by the fact that whereas gastroenterostomy provided immediate relief, it frequently proved to be of temporary duration. As a result, it took many years before gastroenterostomy was fully appraised and, for the most part, discarded because of the high incidence of late complications. This experience certainly serves to emphasize the importance of controlling any tendency toward overenthusiasm relative to the effectiveness of vagus resection and gastroenterostomy until several more years have elapsed.

UNSATISFACTORY ASPECTS OF GASTROENTEROSTOMY

The technical difficulties attending the performance of gastroenterostomy are, of course, not nearly so pronounced as those associated with resection of the stomach, nor is the operative mortality rate so high. Furthermore, mechanical and metabolic disturbances (dumping syndrome), while occasionally encountered soon after operation, are comparatively infrequent. However, acute postoperative retention is not infrequent.

This complication has been observed with great regularity ever since gastroenterostomy was first introduced, and was once popularly known as the "vicious circle." As late as 1930, Finney and Hanrahan reported 13 deaths associated with stomal dysfunction in a series of 260 gastroenterostomies. That efforts to prevent postoperative gastric retention have not, as yet, been altogether satisfactory is attested by the figures presented in recent years from the Massachusetts General Hospital (Allen, 1940) and the Mayo Clinic (Gray and Sharpe, 1946). Allen reported that during the 5 year period preceding 1940, obstruction occurred in 10 per cent of the patients who had undergone gastroenterostomy. In analyzing 2 series of 100 patients each, Gray and Sharpe found that obstruction developed in 35 in the first group (6 requiring exploration, 1 of whom died) and in 19 in the second (none requiring surgical intervention). The latter group represented operations in which a special effort had been made to avoid this complication.

The most vigorous indictment of gastroenterostomy, of course, relates to the frequency with which this operation is followed by an anastomotic ulcer. This is particularly apt to be the

result when the antecedent lesion is located in the duodenum and is associated with a copious flow of gastric juice of high acid-pepsin concentration. That the incidence of stomal ulceration is considerable occasions little surprise when cognizance is taken of the fact that gastroenterostomy not only exposes the more vulnerable jejunal mucosa to the proteolytic action of potent gastric juice, but fails to inhibit any of the phases of secretion or to diminish the rate of flow. Were it not for the buffering action of the alkaline duodenal juices and the more rapid drainage of gastric contents a stomal ulcer incidence of overwhelming proportions would undoubtedly follow.

Pronounced differences in the frequency of this complication have been reported in the past: 6.9 per cent—St. John, 1930; 30 per cent—Berg, 1930; 1.4 per cent—Walton, 1934; 24 per cent—Marshall and Kiefer, 1937; 16 per cent—Lahey, 1940; and 22 per cent—Thorlakson and Hay, 1941. At present most observers believe that stomal ulcers develop in approximately 15 per cent of gastroenterostomies performed for duodenal ulcer. It is well to re-emphasize at this point the fact that the studies of Renshaw and Beck, Allen and Welch, and Priestley and Gibson demonstrated that the majority of anastomotic ulcers occurred within the first 2 years after operation. Priestley and Gibson also found that of the 283 cases they investigated 93.2 per cent followed gastroenterostomy whereas only 6.8 per cent followed partial gastrectomy.

The mortality rate attending the surgical correction of anastomotic ulcers is also variously estimated and is influenced by such factors as the type of operation employed, location of the lesion with especial reference to the midcolic artery and ligament of Treitz, the presence or absence of hemorrhage, and involvement of the transverse colon. The seriousness of anastomotic ulceration is, of course, stressed even more strongly by its tendency to develop into gastrojejunocolic fistula.

Gastrojejunocolic fistula, the most dreaded of complications, was encountered in 11.4 per cent (Priestley and Gibson), 13.9 per cent (Benedict), 13.6 per cent (Walters and Clagett), and 17 per cent (Ransom), respectively, of the cases of anastomotic ulcer which these observers investigated. The great majority were preceded by gastroenterostomy, particularly of the retrocolic type, Atwater and his associates reporting that this procedure had been employed previously in 93 per cent of their cases. In the past, the operative treatment of gastrojejunocolic fistula was associated with an appalling mortality rate, Lahey reporting a rate of 63 per cent. The performance of a preliminary shunting procedure as proposed by Pfeiffer, Lahey, and others served to lower the mortality rate appreciably, 7 per cent being reported by Lahey and Marshall. Recent advances have made it possible to perform one-stage procedures with increasing frequency. The mortality is dependent upon multiple factors and varies considerably. It probably still exceeds 15 per cent.

Discussion

Several more years must pass before the final answer concerning the effectiveness of vagus resection in the surgical treatment of peptic ulcer becomes clear. Nevertheless, sufficient information has already been gathered whereby much of the confusion attending this subject can be resolved and a rational, though perhaps restrained, approach made toward the use of this operation.

Anatomical investigations have shown that all vagal fibers of the stomach cannot always be interrupted with ease if, indeed, all can be interrupted. Hence, vagus resection, to be satisfactory, entails painstaking dissection and is not a simple operation as many are inclined to believe. Furthermore, there is good reason to suspect that parasympathetic flow may reach the stomach over pathways other than the vagi. This possibility has been offered as an explanation for the unreliability of the insulin test as well as for the tendency of inhibited functions to return in time toward their original levels.

Complete vagus resection incites a profound inhibition of the gastric motor and secretory activities (all of the cephalic phase and much of the interdigestive phase). This fact forms the basis for the employment of the nerve operation in chronic peptic ulcer. Generally speaking, the immediate results are striking in persons with duodenal ulcer. Ulcer pain almost invariably disappears promptly and most lesions heal within a short period. Moreover, short-term follow-up studies indicate that recurrences are infrequent notwithstanding the tendency of the stomach to become reactivated. This aspect of the problem is, of course, crucial and merits several years of diligent scrutiny. Much evidence has accrued in support of the contention that the vagus nerves, once interrupted, do not regenerate. Nevertheless, reports are beginning to appear that the benefit of vagus resection is of temporary duration.

Even the most confident proponents of the nerve operation no longer perform only vagus resection in duodenal ulcer but add gastric drainage in an effort to prevent the high incidence of disagreeable postoperative sequelae—diarrhea, intermittent abdominal colic, and, in particular,

gastric retention. The frequency of the last complication is due, in part, to the fact that a large number of surgical duodenal ulcers are associated with some degree of pyloric obstruction.

The occurrence of massive hemorrhage following vagus resection, although distinctly uncommon, accentuates the necessity for removing the lesion when this is at all possible. Acute perforation and the development of gastric ulcers after the nerve operation are also encountered on rare occasions. The latter disturbance, it is suggested, may portend the development of a malignant transformation as a result of the alterations induced by vagus resection.

An insufficient number of gastric ulcers have been treated by interruption of the vagi to permit definite conclusions to be drawn at present. Persistence and recurrence of such lesions have been reported. Jejunal ulcers, on the other hand, respond to vagus resection in a most satisfactory manner. Those which develop after an extensive resection of the stomach, including the antral mucosa, are particularly suitable for the nerve operation since other forms of treatment have proved to be notoriously hazardous and ineffective. Moreover, the rationale appears to be especially sound from a theoretical point of view since the neural phase and most of the chemical phase of secretion are eliminated. The basis for vagus resection is, of course, not so well founded in anastomotic ulcers which follow gastroenterostomy. As a consequence, definite consideration should be given in such instances to gastric resection, perhaps in conjunction with vagus resection, if not prohibited by technical difficulties or undue risk. Partial gastrectomy becomes almost obligatory when the stoma is inadequate or the transverse colon is involved.

The results of vagus resection combined with gastric shunt, usually gastroenterostomy, have been notable to date, although untoward sequelae have not been eliminated entirely. The addition of gastroenterostomy, of course, increases the perplexity of the entire problem for it is well known that this procedure alone is, as a rule, productive of excellent though frequently temporary results. There could be little disagreement over utilizing the advantages of both procedures if the possibility of subsequent anastomotic ulceration could be dismissed. This, however, is not the case at present. It is true that the protective influence of vagus resection is evidenced in several short-term follow-up studies, all of which fail to report the incidence of stomal ulcer ordinarily expected after gastroenterostomy alone during a corresponding period. Nevertheless, the duration of the effectiveness of vagus resection still remains to be ascertained, especially since the inhibition of gastric activities tends to be transient. Furthermore, many years often elapse after gastroenterostomy before stomal ulcers develop. Finally, when consideration is given to the percentage of cases in which, for one reason or another, all the vagal fibers are not interrupted, it becomes apparent that the routine employment of this combined operation disregards its potential consequences and is, therefore, unwarranted. While an open mind must, of course, be kept until time resolves the issue, it would seem to be prudent to restrict this operation to selected cases.

Vagus resection combined with gastric resection, presumably the most effective operation for stomal ulcer, has not received the attention it appears to merit. On the rather infrequent occasions when both procedures have been carried out, a higher morbidity incidence, rarely of a sustained or serious character, was encountered as compared with that following partial gastrectomy alone. Determinations of secretion, however, served to substantiate the premise that the combined operation affords a greater degree of protection against anastomotic ulceration than does partial gastrectomy alone. Thus, while resection of the vagus nerves and the stomach would hardly be advisable for routine use, its employment would seem to be rational in carefully selected cases in which recurrences are likely to be encountered; for example, in individuals with repeated episodes of hemorrhage or acute perforation, and an excessive degree of acidity and a strong emotional element.

The effectiveness of an adequate gastric resection is well recognized even though this operation is admittedly not a sovereign remedy for chronic peptic ulcer. In a high percentage of duodenal ulcers, closure of the duodenal stump occasions a good deal of technical difficulty. The attending mortality rate, of which this is an important cause, is decidedly higher than that associated with vagus resection. In competent hands, however, and at centers where candidates for resection are carefully selected, partial gastrectomy may be carried out with minimal risk and, accordingly, with a low mortality rate. Postoperative gastric retention, while not encountered as often as it is following vagus resection, manifests itself with a greater frequency and proves to be more troublesome than is commonly recognized. Disturbances of a nutritional, metabolic, and mechanical nature tend further to depreciate the value of gastric resection. The prevention of anastomotic ulceration in instances of duodenal ulcer appears to be distinctly related to the adequacy with which certain

criteria are met, the best results having been reported when 75 to 80 per cent of the stomach, including the antral mucosa and most of the lesser curve, was excised and a short afferent loop was utilized in the anastomosis. Removal of the ulcer, while desirable, seems not to be compulsory. Many patients who bleed before operation suffer recurrent bleeding later.

The value of partial gastrectomy is best exemplified by its success in the treatment of the great majority of cases of gastric ulcer. Not only is the fear of malignancy eliminated but anastomotic ulceration almost never ensues, the patient is seldom left with distressing sequelae, and the mortality rate is minimal, principally because the duodenum lends itself, as a rule, to secure closure. Occasional ulcers located near the cardia, however, pose a serious problem. Whether total gastrectomy, partial gastrectomy distal to the lesion, segmental esophagogastrectomy including the lesion, or vagus resection is performed, none is without distinct limitations or hazards. Hence, the selection of the procedure is best determined by the circumstances of each case.

Partial gastrectomy has proved to be effective in the great majority of instances of stomal ulcer following gastroenterostomy. Moreover, the mortality rate has been currently lowered to modest proportions. This is not the case with further resection for stomal ulcer developing after previous gastrectomy. Hence, when the original operation has been reasonably adequate and when the colon does not appear to be in jeopardy, vagus resection is a more rational approach.

Gastroenterostomy alone has generally been discontinued. As indicated, this is due to the high incidence of stomal ulcer which is apt to occur, often after several years, in patients with duodenal ulcer and excessive acid secretion. Furthermore, such lesions tend to develop into the even more serious complication, gastrojejunocolic fistula. These facts should be kept in mind when the performance of a gastroenterostomy is contemplated. Nevertheless, simple gastroenterostomy may occasionally prove to be advisable in elderly people in poor condition, with low acid values, and in whom technical difficulties preclude the use of more extensive surgery.

TYPE OF OPERATION RECOMMENDED FOR PEPTIC ULCER

For a sound approach to the operative treatment of chronic peptic ulcer, full consideration must be given to the fact that our understanding of this disease is decidedly limited and, to a large extent, conjectural. There can be little doubt that, as the perplexity unravels itself, much of the advice now offered will prove to be inconsequential, if not erroneous. In fact, chronic peptic ulcer should not require surgical treatment in its management except, perhaps, on rare occasions. That it frequently does is not a tribute to the excellence of present surgical procedures but an admission of the urgent need for effective methods of preventing complications and of excluding the presence of a malignant lesion.

The experience with gastroenterostomy should serve as a warning against the unrestrained employment of an operation of which the effects have not been followed over a sufficient period of years for a complete and therefore accurate appraisal. In the past, much of the haste in adopting a procedure was, of course, prompted by necessity since what few alternatives were known were distinctly objectionable. This, however, is not the case at present for, while a more satisfactory method is admittedly desirable, premature wide-scale adoption of a new operation is indefensible in view of the availability of other measures. The most satisfactory of these, partial gastrectomy, has been scrutinized and, in general, not found wanting.

Time alone will settle the issue whether vagus resection, supplemented with a drainage procedure, will supersede partial gastrectomy. From present indications this appears most unlikely. In the meanwhile it would seem logical to concentrate the surgical treatment of peptic ulcer around partial gastrectomy. Until vagus resection has been evaluated completely, its use as well as that of less effective operations should be restricted to those occasions in which partial gastrectomy tends to be unduly hazardous and unsatisfactory.

It is evident that the surgical treatment of peptic ulcer cannot be carried out to the best advantage on all occasions by the use of the same operation, notwithstanding the vigorous endorsement by its proponents. Moreover, the preference for certain procedures often becomes apparent only when the lesion has been inspected with the abdomen open. Therefore, the best interests of the patient and the surgeon will be served if the type of operation is not determined and scheduled in advance. The surgeon who essays to treat peptic ulcer must be prepared to meet the demands of the occasion with the proper procedure, the final selection of which is held in abeyance until the ulcer is examined directly.

GASTRIC ULCER

In view of the several considerations referred to above, the procedure of choice in the presence of gastric ulcer is partial gastrectomy. It is, of

course, essential that this operation be performed by an experienced surgeon and one who is familiar with the criteria of an acceptable resection. Ulcers located near the cardia may necessitate other measures (see previous pages). If the entire lesion is not removed every effort must be made to obtain a portion of tissue for microscopic examination. The presence of cancer, of course, warrants the risk of a more extensive operation.

ANASTOMOTIC ULCER

Anastomotic ulcers which develop after an extensive gastric resection in which the antral mucosa has been removed should be subjected to vagus resection, the transthoracic approach being utilized if possible. If the partial gastrectomy has not been adequate or if the colon is involved, further resection should be carried out, the patient's condition permitting.

Vagus resection may also be performed to advantage in instances of anastomotic ulceration following gastroenterostomy when more extensive surgery is precluded because of the poor condition of the patient or because of undue technical hazards, such as a short afferent loop, distortion of the transverse mesocolon, and anastomotic loops. Otherwise partial gastrectomy is recommended as the procedure of choice. This operation becomes virtually obligatory if the transverse colon or a large blood vessel has become involved or if the patency of the stoma is compromised.

DUODENAL ULCER

Whereas the majority of gastric and anastomotic ulcers require operative intervention, approximately 85 per cent of ulcers located in the duodenum respond satisfactorily to a program of medical therapy. Those which do not are, in the main, associated with distinct anatomical alterations of which the correction is dependent upon mechanical means. Moreover, since such lesions are prone to pose a good deal of difficulty relative to closure of the duodenal stump, an acquaintance with modified closures is essential when duodenal ulcers are treated by partial gastrectomy.

Intractable pain. Partial gastrectomy is recommended for intractable pain if the condition of the patient permits. Vagus resection is added if the sensitivity to stress is great and the degree of preoperative gastric acidity is high. In the occasional instances in which a nutritional problem exists along with a strong emotional element, vagus resection may be preferable if the patency of the pyloric canal is not compromised. Attempts should not be made to remove stenosing ulcers located near the entrance of the common bile and pancreatic ducts. When modified closure of the duodenal stump seems to entail undue risk, vagus resection and gastric drainage may occasionally be warranted in the presence of pyloric obstruction.

Obstruction. Partial gastrectomy should be performed when possible. On those occasions when the condition of the patient is precarious or closure of the duodenal stump is likely to be unsatisfactory, vagus resection combined with gastric drainage may be employed. Simple gastroenterostomy alone may be indicated under such circumstances, particularly when the patients are elderly and the concentration of acid is low.

EMERGENCY SURGERY

Perforation. Simple closure should be carried out in all but the occasional instance when partial gastrectomy may be deemed more advisable.

Hemorrhage. Partial gastrectomy is to be preferred whenever conditions permit. Local ligation beyond the confines of the ulcer may occasionally prove to be satisfactory. When the vagus nerves are resected, an effort must also be made to remove the ulcer, vagus resection alone being contraindicated.

INTERVAL SURGERY

Perforation. When possible, gastric resection is the procedure of choice. It may be well to resect the vagi as well as the stomach if a strong emotional element exists, the preoperative acid values are high, or acute perforation has taken place on more than one occasion previously. Vagus resection alone is contraindicated because patency of the pyloric canal tends to be compromised.

Hemorrhage. Partial gastrectomy, including removal of the ulcer, is preferred when at all possible, in combination with vagus resection. As has been noted, the latter procedure is added because of the frequency with which hemorrhage tends to recur even after an extensive partial gastrectomy. Should closure of the duodenal stump prove too difficult, as it frequently does in these cases, division of the stomach may be performed proximal to the pylorus. The antral mucosa, however, must be removed except possibly in old people whose general condition is poor and in whom acid secretion is minimal.

SUMMARY

Resection of the vagus nerves has not proved to be the sovereign surgical remedy for duodenal, gastric, and anastomotic ulcer, as many anticipated originally. Not only does healing fail to materialize in all instances but the safeguard against recurrence tends in time to dissipate itself

as the inhibitory effects of this operation are transient. Moreover, such untoward postoperative sequelae as gastric retention, diarrhea, and recurrent epigastric pain are encountered with sufficient frequency to preclude the routine use of vagus resection alone. Aside from these considerations, the remote possibility must be entertained of the tendency toward the development of malignancy in an unresected stomach deprived of its secretory and motor activities.

In general, vagus resection is more effective when supplemented by gastric drainage. There is, however, reason to suspect that the success of this combination may be the consequence primarily of the addition of the latter procedure. In any event, until incontrovertible evidence is available that vagus resection, in itself an incomplete attainment in many instances, exerts permanent protection against the occurrence of stomal ulceration, there would seem to be little justification for the indiscriminate use of both of these procedures.

On the other hand, "adequate" partial gastrectomy has been evaluated thoroughly and, in the main, found to be productive of excellent results. By "adequate" is meant the excision of 70 to 80 per cent of the gastric mucosa, including that of the antrum, the major portion of the lesser curvature, and a short jejunal loop anastomosis.

It would, therefore, seem rational at present to concentrate the surgical treatment of chronic duodenal, gastric, and anastomotic ulcer around extensive resection of the stomach. Vagus resection, gastric drainage, or both should be reserved for those occasions when partial gastrectomy is likely to be ineffective, if not unduly hazardous, as in patients with:

1. An anastomotic ulcer following extensive partial resection.

2. An adherent ulcer in the region of the ampulla of Vater for which an exclusion operation with exenteration of the antral mucosa is considered unsuitable.

3. An ulcer high up on the lesser curvature for which more radical measures appear to be unjustified.

4. A duodenal ulcer, the patients being young and emotionally unstable and presenting a nutritional problem.

It would also seem prudent to supplement partial gastrectomy with vagus resection in those instances in which recurring episodes of massive hemorrhage or acute perforations have taken place previously.

Thus, to attain the maximum benefit, each case must be evaluated separately and the selection of the operation held in abeyance until the abdomen has been opened and the lesion inspected directly.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Tumors of the Parotid Gland. Robert W. Buxton, James H. Maxwell, and Donald R. Cooper. *Laryngoscope*, 1949, 59: 565.

Between July, 1934 and January, 1949, 272 patients with primary tumors of the parotid gland were admitted to the University of Michigan Hospital. In 204 patients the lesion was excised; biopsy alone was performed in 14 patients, and 9 patients were seen subsequent to operation elsewhere. Histologic study revealed 113 benign mixed tumors, 95 carcinomas (41 were considered to be of ductal origin and 54 were engrafted upon a previously benign mixed tumor), 9 sarcomas, and 10 cases of papillary cystadenoma lymphomatosum.

The widely held impression that recurrent mixed tumors tend to become progressively more malignant in character after excision could not be confirmed. The authors believe that time is a factor of greater moment in this transformation than is that of repeated surgical trauma.

The diagnosis of parotid gland tumor is seldom difficult to establish though infrequently the issue may be confused by hypertrophy of the masseter muscle, perhaps a clinical entity in itself. Preoperative facial paralysis and disseminated metastases are the only reliable signs of malignancy. Such evidences, of course, do not manifest themselves until spread occurs.

Removal of these tumors was accompanied by a surgical mortality rate of 0.49 per cent. The overall incidence of recurrence proved to be 13.3 per cent. While 10.9 per cent of benign mixed tumors reappeared, this was attributed to the fact that an incomplete operation had been performed, principally for fear of damaging the facial nerve. No recurrence was encountered in the group of papilliferous cystadenoma lymphomatosum. Of those patients with malignant tumors who were operated upon more than 5 years ago, 68.1 per cent survived without evidence of recurrence, the incidences being lower in those with primary sarcoma or carcinoma, i.e., 54 and 50 per cent respectively.

It is for these reasons that the authors believe a pessimistic attitude toward the prognosis of patients with parotid tumors is not warranted. They urge that all such tumors be removed completely as soon as discovered unless widespread dissemination is present. When metastatic spread appears to be confined to the regional cervical nodes, radical neck dissection is indicated.

In discussing the technique of excising the tumor (or the gland, if the tumor is unencapsulated), emphasis is placed on several methods of exposing and safeguarding the facial nerve, including the use of an electrode of a simple faradic excitor. The nerve is deliberately sacrificed only when evidence of neoplastic invasion is present prior to operation, or is discovered in the course of surgery.

Permanent facial paralysis occurred in 30 patients, in 13 of whom its occurrence was accidental. However, the latter group included only 1 instance of complete paralysis; in the remaining 12, the paralysis caused only minimal distress since it was localized generally to the lower lip. Six temporary salivary fistulas developed, all of which healed spontaneously.

Roentgen therapy was employed sparingly. The authors believe its employment should be confined to cases following an incomplete operation or as a substitute when surgery is contraindicated.

David H. Lynn, M.D.

EYE

Diagnosis of Orbital Tumors. Antonio Grino and Edwin Billet. *Am. J. Ophth.*, 1949, 32: 897.

The localizing value of angiographic visualization of intraorbital tumors was demonstrated in 3 patients presenting unilateral exophthalmos. After local anesthesia, a special 17 gauge needle is inserted into the common carotid artery and 10 c.c., or less, of 35 per cent diodrast are injected at the highest possible speed. A system of rapid changing of the x-ray plates is indispensable in obtaining the three phases of the angiogram; namely, the arteriogram, the capillarogram and the venogram.

Use of the technique in one patient allowed demonstration of a highly vascularized intraorbital tumor with possible intracranial extension, presumably a hemangioma. Roentgen therapy to the involved orbit caused an improvement in visual acuity, but no recession of the exophthalmos. In the second patient angiography revealed tumors of the right cerebral hemisphere and left orbit, which proved to be metastatic hypernephromas. In the third patient the diagnosis of a sphenoidal ridge meningioma without orbital extension was confirmed by angiography.

It is recommended that angiography be used in the diagnosis of unilateral exophthalmos in preference to pneumoencephalography, puncture biopsy, or intraorbital air injection.

Frank W. Newell, M.D.

Dermoid and Epidermoid Tumors of the Orbit. Raymond L. Pfeiffer and Russell J. Nicholl. *Arch. Ophth.*, Chic., 1948, 40: 639.

Nine cases of intraorbital dermoid tumors are presented, and the authors discuss the characteristic

defects in the bones of the orbits which can be recognized roentgenographically.

The differentiation of dermoids from epidermoids seems unimportant as they all have their origin in congenital rests from primitive ectoderm and mesoderm and the composition of each type depends on the period of time during which the cell rest developed.

The size of dermoid tumors varies from that of a small seed to that of an apple. They are encapsulated, and are oval, round, or hourglass in shape; they are of soft consistency, cystic, and are usually yellow or brown in color. Many contain hair, skin and teeth. The microscopic appearance of these tumors is discussed.

Epidermoids are usually solid masses enclosed in tough, fibrous capsules.

In the present series of 9 cases of tumors of this type, all were cystic and contained brown fluid, oily in character, and all had fibrous walls and epithelial linings. Some dermoids arise in diploe of bones of the skull or orbit; growth causes the inner and outer table to expand and produces characteristic x-ray defects. These tumors have sharply demarcated margins with an increase in the density of bone at the margin, and a diminished tissue density within the tumor.

Drawings and x-ray pictures accompany the article. EARL H. MERZ, M.D.

The Formation of the Intraocular Fluid. JONAS S. FRIEDENWALD. *Am. J. Ophth.*, 1949, 32: 9.

Studies with the aid of refined techniques have shown that the chemical composition of the aqueous is not exactly that of a dialysate of the blood plasma. There are definite and important discrepancies. Nevertheless, the overall resemblance is approximately true, and the existence of some diffusional exchange between blood and aqueous may be accepted as thoroughly established. There is, indeed, a very strong a priori reason for expecting this to be true, because in the iris at least the capillaries expose their naked walls to the intraocular fluid.

The conclusions which seem justified from studies on the chemical composition of the aqueous may be summarized as follows: (1) hyaluronic acid is secreted into the ocular fluid in the sense that it is synthesized locally; (2) ascorbic acid, certainly, and glucose, possibly, are secreted into the intraocular fluids in the sense of active transfer from plasma to aqueous; (3) the osmotic measurements of Duke-Elder and Davison, and the transport measurements of Kinsey and Grant are compatible with the notion that electrolytes are actively secreted into the ocular fluid, that water follows by osmosis, that urea and like substances are filtered out in the process, and that the reabsorption of the intraocular fluid is by a process equivalent to leakage.

If we had a full knowledge of how each component of the intraocular fluid is transferred across the secretory boundary, we would still stand only on the threshold, for the secretory organ that we have so far identified can act only on the fluid and solutes in the ciliary stroma. Transfer from plasma to extravascular fluid spaces in the ciliary stroma is required in order to make fluid and solutes available to the secretory organ.

The findings so far present few implications with respect to the pathologic physiology or control of glaucoma. At most, they raise the question as to whether more effort might not profitably be directed toward a reduction in the formation of aqueous in cases of glaucoma, in addition to the present approach which concerns largely an effort to increase the outflow of fluid from the eye.

MICHEL LOUTFALLAH, M.D.

Aureomycin in Ocular Infections: A Study of Its Spectrum. ALSON E. BRALEY and MURRAY SANDERS. *Am. J. Ophth.*, 1949, 32: 119.

Aureomycin borate has been used locally, and aureomycin hydrochloric acid has been used intramuscularly in 401 patients with a wide range of ocular infections. The local use of a 0.5 per cent solution produced no damage to the conjunctiva or cornea.

This antibiotic was found to be effective against mild or severe staphylococcal infections of all types, and appeared to be as potent as local penicillin (1,000 units per cubic centimeter). Excellent results were obtained in the treatment of pneumococcal, meningococcal, and influenzal conjunctivitis.

The diplobacillus of Morax-Axenfeld is an organism which has not responded well to any form of therapy. From all clinical appearances, however, aureomycin is much more effective against the diplobacillus than any other means of therapy. It was also found to be an effective therapeutic agent in inclusion conjunctivitis and in herpes simplex of the cornea.

Its therapeutic effect in epidemic keratoconjunctivitis will require further investigation before results can be evaluated. It is, however, more effective in epidemic keratoconjunctivitis than any of the other antibiotics or drugs tried.

There is some indication that aureomycin may be a valuable antibiotic in the treatment of uveitis.

The intramuscular administration of aureomycin hydrochloric acid did not give rise to any toxic reactions, and in only one individual was any general effect noted. The patient developed a secondary anemia which was easily controlled by the administration of iron.

The hydrochloric acid is somewhat irritating on intramuscular injection, but this irritation can be controlled by the addition of a small amount of procaine hydrochloride. MICHEL LOUTFALLAH, M.D.

Effectiveness of Streptomycin in the Treatment of Experimental Conjunctivitis Caused by Hemophilus Sp. DORLAND J. DAVIS and MARGARET PITTMAN. *Am. J. Ophth.*, 1949, 32: 111.

During October, 1947 an investigation was directed toward the elucidation of the etiology and

epidemiology of epidemic conjunctiva commonly called "gnat sore eyes." An opportunity was afforded to inoculate 8 human volunteers with a strain of Hemophilus sp. The strain for inoculation had been isolated from the conjunctiva of a 7 year old Hidalgo County school girl who had a mild conjunctivitis of 30 hours' duration. Six of the 8 inoculated volunteers developed a severe conjunctivitis corresponding clinically to that observed among the population of the Rio Grande River Valley, and a hemophilic bacterium indistinguishable from the inoculated one was recovered from the affected eyes. In general, the first symptom noticed by the patients was an itching or scratching of the inoculated eye about 6 hours after instillation of the culture. The following morning the eyelids were adherent with dried exudate, the eye was painful, the bulbar and palpebral conjunctivas were hyperemic, and a moderate amount of yellow mucopurulent material was present in the conjunctival sac.

On the third day, 48 hours after inoculation, all the signs and symptoms were exaggerated and the bipalpebral edema was increased to the extent of closing the eye in some cases. Photophobia was more pronounced.

Forty-eight hours after inoculation, the 8 patients were separated into 3 groups for evaluating specific treatment. Streptomycin hydrochloride in a concentration of 1 mgm. per milliliter of 0.85 per cent sodium chloride solution was applied locally with an eyecup to the affected eye of 3 patients every 2 hours, from 6 a.m. until 10 p.m. for various time periods. A second group was treated similarly with a mixed solution of streptomycin in the same concentration, and rivanol lactate in a concentration of 0.2 mgm. per milliliter. Two patients were treated locally with 0.85 per cent sodium chloride solution, until the eighth and ninth days, as a control for the specific therapy administered to the other patients. The 4 patients who received specific therapy showed marked clinical improvement beginning about 8 or 10 hours after the start of treatment, with definite relief of pain and diminution of the exudate.

The immediate effectiveness of streptomycin, and streptomycin in combination with rivanol lactate applied locally to the infected eye, in relieving the signs and symptoms and in reversing the cultural findings is encouraging. It remains to be determined whether other methods of topical application (instillation or irrigation) and a less rigid treatment schedule would be as effective.

MICHEL LOUTFALLAH, M.D.

The Surgical Treatment of Pterygium. H. SAUL SUGAR. *Am. J. Ophth.*, 1949, 32: 912.

The theory is presented that pterygium develops from a pinguecula, an initial degenerative process leading to hyperplasia and hypertrophy of the elastic tissue of Tenon's capsule. Changes in the cornea adjacent to this area then lead to the formation of connective tissue which contracts and pulls Tenon's capsule and the conjunctiva onto the cornea. On the basis of this theory, a new surgical procedure which has been used successfully in approximately 50 cases is proposed.

Anesthesia is induced by topical cocaine and infiltration of procaine under the body of the pterygium. A vertical conjunctival incision is then made just behind the advancing edge of the pterygium, extending from its lower to upper border and then laterally at each border to the limbus. The entire conjunctival covering of the pterygium is then undermined through this incision. A second incision in the same position as the first is then made through the "tendinous" layer of Tenon's capsule. This tissue is then undermined for approximately 5 mm. from the limbus and about a millimeter from the borders of the pterygium, and excised. The attached head of the pterygium is then shoved from the cornea. A black silk suture is then inserted into the sclera 3.5 mm. from the limbus and through the cut conjunctiva, leaving an uncovered patch of sclera between the conjunctiva and cornea. A monocular dressing is applied and the suture is removed the fourth postoperative day.

FRANK W. NEWELL, M.D.

Regeneration of Corneal Stromal Cells. A. EDWARD MAUMENEE and WALTER KORNBLUETH. *Am. J. Ophth.*, 1949, 32: 1051.

Difference of opinion as to the mode of regeneration of corneal stromal cells following injury to the cornea stimulated the authors to undertake further experimental work with a freezing technique.

Previous workers have believed the cell replacement to be due to (1) undamaged corneal corpuscles, (2) wandering cells outside the cornea, (3) transformation of epithelial or endothelial cells, and (4) a combination of these modes.

The authors' conclusions, (after destroying the cornea by freezing) are that regeneration of corneal stromal cells is effected by (1) replacement by corneal corpuscles, and (2) replacement by wandering macrophages.

EARL H. MERZ, M.D.

Circular Corneal Transplants: Surgical Technique; Instruments and Sutures; Comparison with the Use of Square Transplants. FREDERICK C. STANSBURY. *Arch. Ophth.*, 1949, 42: 155.

Transplantation of the square corneal graft is a difficult procedure, with uncertain results. The corners of the graft exhibit a tendency to bulge forward unless the suture passes exactly over the apex of each corner. Circular corneal transplants are easily marked, a perfect circle can be expected, and completion of the incision with scissors is relatively simple. The cosmetic result is better, and less postoperative astigmatism follows. The simple Elliott type of manual trephine is recommended.

The pupil is maximally dilated with 10 per cent neosynephrine and 5 per cent homatropine before operation. After fixation of the eye with an Elschnig forceps, a superficial incision is made with the corneal trephine selected (4.5, 5.5, or 6.5 mm.).

Fluorescein is instilled and washed out. A broad suture is placed in the corneal stroma about 1 mm. from the green circle at 9 and 3 o'clock, and another at 12 and 6 o'clock. Another suture in the center of the circle is loosely tied. The trephine incision is then continued until the anterior chamber is reached. With traction on the central suture, the incision is completed with curved corneal scissors. The graft from the donor eye is washed in Ringer's solution to remove any adherent pigment, and is then inserted. The horizontal and vertical sutures are separately tied, criss-crossing, and without tension. Should the graft still bulge, a suture is passed from limbus to limbus so that it passes over the bulge and compresses it. Air may then be injected into the anterior chamber and the wound edges adjusted with spatula. A 3 per cent solution of atropine is instilled and a binocular bandage applied. Complete bed rest is prescribed for 9 days. The patient is kept comfortable and quiet with aspirin and barbiturates, and visitors are discouraged. Dressings are changed every third day, when the neosynephrine and homatropine are again instilled. The corneal sutures are removed on the sixth day. The unoperated eye is uncovered at the third dressing, and the patient is allowed up at the fifth dressing. Pressure dressings are maintained on the operated eye for a period of from 3 to 6 weeks, and refraction is done only after 2 months. JAMES E. LEBENSOHN, M.D.

Retrolental Fibroplasia. ANITA PEEK GILGER. *Am. J. Ophth.*, 1949, 32: 917.

A survey for retrolental fibroplasia was made in 229 infants born prematurely between January, 1943 and January, 1948 at the Cincinnati General Hospital. No cases of fibroplasia were found in the group weighing more than 1,814 gm. at birth. Among 96 infants with birth weights of 1,814 gm. or less, 7 were found to have retrolental fibroplasia. A significant increase in survival, until hospital discharge, of infants with birth weights between 1,362 and 1,814 gm. was observed during this period, but it was not associated with an increase in the number of cases of retrolental fibroplasia.

The following maternal factors were considered and found to be not significant: uterine bleeding during pregnancy; age and parity of the mother at delivery; occurrence of virus infection or chronic illness during prenancy; race; and the cause of premature onset of labor.

The predominance of males (7) over females (0) was statistically significant. The incidence in children who were given, and in those who were not given vitamin A during the first month was not significant, but a conclusive statement that vitamin A did not play a role in the development of retrolental fibroplasia was not possible. Only 1 of 5 children with retrolental fibroplasia showed mental retardation.

Three infants developed retrolental fibroplasia during the period of observation. During the first 2 weeks of life the eyes were normal. The fetal vessels played no part in the development of retrolental fibroplasia. The first indication of abnormality was the development of considerable tortuosity of the retinal vessels. Preceding the development of a retrolental membrane, the retina became elevated and detached; in 2 cases hemorrhages were present on the surface of the detached retina. After the retinal detachment had persisted the eye became white in appearance instead of gray, as if a little fibrous tissue had developed. A varying degree of vitreous cloudiness was observed, but at no time was there any indication of anterior uveitis.

FRANK W. NEWELL, M.D.

Heredity and Retinoblastoma. ALGERNON B. REESE. *Arch. Ophth.*, 1949, 42: 119.

Retinoblastoma is reputed to occur only once in 34,000 births. In the author's complete series of 184 cases of retinoblastoma there were only 5 survivors with children. The total number of children was 8, and 7 of these had bilateral retinoblastoma. These impressive figures indicate that a survivor of retinoblastoma should not have children.

Patients with sporadic retinoblastoma (the progeny of healthy parents) had 103 siblings, only 1 of which had retinoblastoma. The probability of a sibling being affected is thus about 1 per cent. The author consequently does not hesitate to advise healthy parents who have had one child with retinoblastoma to have more children.

JAMES E. LEBENSOHN, M.D.

EAR

Effect on the Ear of Vitamin A Feeding After Severe Depletion. H. B. PERLMAN. *Arch. Otolar.*, Chic., 1949, 50: 20.

The remodelling of the skull to accommodate the growing nerve tissue within it is controlled in part by the action of vitamin A. In vitamin A depletion, there apparently is a "failure to absorb older formed bone to allow for the growth of the central nervous system as well as the laying down of new bone." As regards the temporal bone changes in vitamin A deficiency, the interpretation has varied. "The picture is one of apparently excessive periosteal bone formation on the inner surface of the temporal bone involving the acoustic meatus."

The object in these experiments was to determine the degree to which the developed pathologic changes might be changed by feeding vitamin A. Rabbits were used. Studies were made of the control group (complete diet), depleted animals (vitamin A free diet) and depleted animals who subsequently were fed vitamin A.

In the group of animals depleted for 5 months or until death, new bone formation was uniformly seen on the intracranial aspect of the temporal bone with and without degeneration of the eighth cranial nerve fibers and ganglion cells. Good acoustic function, as tested by the middle ear muscle reflex, was present until severe nerve compression (due to new bone in

the internal auditory canal) occurred. Labyrinthitis did not seem to be a primary effect of vitamin A deficiency.

The amount of this new bone formation remained essentially the same even after 6 months of vitamin feeding to the depleted animals. The bone, however, did become more compact as many vascular connective tissue spaces were replaced by bone. Secondary changes in the neural elements of the eighth nerve showed no signs of repair.

JOHN J. BALLENGER, M.D.

Origin of the Caloric Reaction of the Labyrinth. L. B. W. JONGKEES. *Arch. Otolar.*, Chic., 1948, 48: 645.

Barany's explanation of the origin of the vestibular response to caloric tests is the most tenable in the light of present knowledge. In his opinion, the change in temperature which occurs at the drum membrane is conducted toward the semicircular canals by the structures in the temporal bone. The temperature of the endolymph fluid in the semicircular canals likewise changes; heating lowers the specific gravity and cooling raises it. A flow of endolymph is produced which is dependent upon the position of the canal. This theory explains the origin of the nystagmus, and the sensation of turning and past pointing. It explains also why the nystagmus can be reversed by reversing the position of the head in respect to gravity. Not all reactions to the caloric test are explainable by this theory. The fact that a reaction may be elicited after a semicircular canal or the entire labyrinth has been destroyed is not explained. Directional preponderance is not accounted for by this theory.

Bartels suggested that the caloric reaction had a direct effect on the nerves. Kobrak believed that vascular reactions were important. The vessels at the periphery of a labyrinth are constricted by a cold stimulus and the central vessels consequently react with dilatation. By these changes in the vessels a flow of endolymph is caused.

The author believes that the thermal reaction should be considered as a reaction of the entire labyrinth, especially of the horizontal canals, but also of the vertical canals and the otoliths in some instances.

The unexplained reactions to the caloric test are probably due to the presence of more than one natural variable.

JOHN R. LINDSAY, M.D.

Otogenic Intracranial Hypertension. S. HOROWITZ. *J. Lar. Otol.*, Lond., 1949, 90: 363.

In this syndrome there is an increased intracranial pressure with the usual associated symptoms of headache, nausea, and vomiting. Findings consist of papilledema accompanied by small hemorrhages and occasional patches of exudate. There is a generalized constriction of the visual fields and occasionally paralysis of the sixth cranial nerve. Lumbar puncture reveals a normal spinal fluid with the pressure increased to exceed 300 mm. of water. If the pressure of the spinal fluid is not reduced, there is eventually a central optic atrophy and blindness. Otogenic intracranial hypertension has been recognized for many years and has been designated by many different names, the most well known of which is optic hydrocephalus. Most commonly this occurs as a complication of acute or chronic otitis media. It has also been known to complicate sinusitis and tonsillitis and to occur without any apparent etiology. Otogenic intracranial hypertension is differentiated from otogenic brain abscess because the symptoms of the latter develop much later and more slowly, and the spinal fluid shows increased cells and a slight excess of protein, a lower pressure and less papilledema. In tumors of the posterior fossa, the onset is slower and it is progressive, although perhaps intermittent at first, and there are cerebellar neurologic signs. Ventriculography is normal in otogenic intracranial hypertension.

The author examines the various theories as to the etiology of otogenic intracranial hypertension. He believes that the condition is due in most cases to interference with the venous return from the cranial cavity, usually from a thrombosis of both of the lateral sinuses or jugular bulbs, or a unilateral sinus thrombosis with absence of the contralateral sinus. He presents 3 cases of otogenic intracranial hydrocephalus which tend to support his theories regarding the etiology. The prognosis of this condition depends upon early diagnosis and therapy. Neglect may result in optic atrophy and permanent blindness. Treatment consists in a reduction of the intracranial hypertension. This can sometimes be accomplished by repeated spinal taps or dehydration therapy. If the condition does not rapidly respond, however, a subtemporal decompression should be done as this is an almost sure method of preventing the development of blindness.

WILLIAM K. WRIGHT, M.D.

NOSE AND SINUSES

A Study of Ciliary Activity in the Respiratory Tract of Animals. JOHN JACOB BALLENGER. *Ann. Otol. Rhinol.*, 1949, 58: 351.

The knowledge is meagre of what happens to the cilia of the respiratory tract in an acute allergic attack. To gain information on that score, rabbits were experimentally sensitized and then the respiratory cilia were observed for any departure from normal at the time of the introduction of the antigen.

Female rabbits were used. Group A consisted of normal animals and group B consisted of sensitized animals. Sensitization was accomplished by injections of 0.5 c.c. per kgm. of horse serum under the skin of the back or abdomen every 5 to 7 days. Usually, after from the sixth to the ninth injection, an ulcer (Arthus' phenomenon) developed and was accepted as a criterion of sensitivity. The extirpated ciliated mucous membrane (usually the trachea) was then observed (using the ultropak microscope) for ciliary activity under various conditions.

The results were as follows:

In group A, consisting of 11 nonsensitized rabbits, the excised specimens of the trachea were cut into sections as described. One specimen from each animal was placed in 0.85 per cent saline as a control. Of eleven specimens observed for ciliary activity from time to time over a period of 2 to 28 hours, no lessening of activity was noted. Five specimens, after being observed and found to exhibit vigorous ciliary activity, were immersed in 50 per cent horse serum diluted with 0.85 per cent saline, and vigorous ciliary activity was noted 25 to 70 minutes later. Five specimens were also tested in 17 per cent horse serum, and undiminished ciliary activity was noted 3½ to 28 hours later. Thus, it is apparent that with the two more dilute solutions of horse serum (17% and 10%), there is no acute qualitative decrease in ciliary activity. In the case of the 50 per cent solution, the ciliary motion was appreciably less than in the controls, but the factor of lack of isotonicity enters here and influences the result.

In group B, the rabbits had been sensitized to horse serum, as evidenced by the development of Arthus' phenomenon. Seven rabbits were included in this group, and the cilia, after various periods of immersion in the control solution (0.85 per cent saline) and in the three test solutions, were examined periodically for qualitatively vigorous ciliary activity. The test solutions were the same as used in the animals in group A. The introduction of the ciliated specimens from the sensitized animals into the solutions containing the antigen (horse serum) did not cause an acute decrease in ciliary activity.

In group C, 6 rabbits (2 nonsensitized and 4 sensitized to horse serum as evidenced by the development of Arthus phenomenon) were used. The procedure differed from that already described inasmuch as the 2 nonsensitized animals were killed by an overwhelming dose of a 1 to 1,000 solution of histamine. The tracheal cilia were immediately examined under the ultropak microscope and vigorous ciliary activity was noted. Four sensitized animals were then killed as previously described with nembutal given intravenously. After exposing the tracheal cilia, histamine (1 to 1,000) was dropped directly onto the ciliated surface under direct vision through the microscope. Again no qualitative change in the vigor of the ciliary activity was noted.

Summary and conclusions. A general review of the literature on respiratory ciliary activity is given and an attempt is made to answer the question of the effect on ciliary activity of the induced allergic state in the rabbit.

No acute qualitative depression in ciliary function in the nonsensitized or sensitized rabbit was observed when the antigen (horse serum) was introduced. The cilia of sensitized and nonsensitized animals were not qualitatively depressed in function by either an overwhelming intravenous dose of a 1 to 1,000 solution of histamine, or the local application of a 1 to 1,000 solution of histamine directly onto the cilia. JOHN J. BALLENGER, M.D.

Benign Cysts of the Paranasal Sinuses. HAROLD F. SCHUKNECHT and JOHN R. LINDSAY. *Arch. Otolar.*, Chic., 1949, 49: 609.

In the present article the authors deal extensively with benign cysts of the nasal sinuses. The article is profusely illustrated with x-ray photographs, pathological specimens, and photographs before and after operation. Many case histories are presented.

In a summary of the article, the authors state that benign cysts of the paranasal sinuses may be divided into two groups—those arising from the sinus mucosa and those of dental origin. Cysts arising from sinus mucosa are of three types:

1. Nonsecreting cysts, found in the maxillary sinus. They arise in the connective tissue layer as a result of chronic inflammation and contain straw-colored fluid of high protein content. As they become large, both local and general toxic symptoms may be produced. They have a thin wall, and rupture before causing deformity.

2. Small retention (glandular) cysts. These are common in hyperplastic sinus mucosa and are probably due to obstruction of the duct by hyperplastic epithelium. They occur as part of the pathologic process in chronic inflammatory disease of the sinuses; they are not individually evident in roentgenograms but may be seen during surgical removal of the mucosa.

3. Mucoceles. These are commonly found in the frontal and ethmoidal sinuses. They are apparently due to obstruction of the outlet of the sinus into the nose. They erode the bony walls and may produce facial deformity. JOHN F. DELPH, M.D.

Transitional Cell Carcinoma of the Paranasal Sinuses. LEROY A. SCHALL and DAVID W. BREWER. *Ann. Otol. Rhinol.*, 1949, 58: 381.

Five cases of lymphoepithelioma, or transitional cell carcinoma involving the paranasal sinuses, are presented. In 4 of these, the initial tumor site appeared in the sinuses but the initial symptoms frequently directed attention elsewhere. X-radiation supplemented, when necessary, with surgery for drainage of superimposed infection, was used. Symptomatic treatment was given as indicated.

JOHN J. BALLENGER, M.D.

MOUTH

Fat Substitutes in Cheek Deformities. D. TEPLITZKY and L. R. RUBIN. *Plastic & Reconstr. Surg.*, 1949, 4: 269.

The problem of substituting a fat-stimulating material for soft tissue defects of the face has not been solved. Unfortunately, an undeterminable degree of absorption occurs, leaving the result of the operation in doubt. To compensate for the absorption, it has been customary to stuff the defect, hoping that by such overcompensation, enough material would escape absorption to fulfill the need. If the deformity was bilateral the end result was very poor, since facial symmetry was impossible to achieve.

All sorts of foreign substances have been tried, from paraffin in the old days to vitallium and tantalum in recent years.

To help solve this problem, all soft and elastic plastics were investigated. Sponge latex rubbers were eliminated because of tissue intolerance. The soft plastics, known as vinyl acetates, were then checked. It was found that the elastic quality imparted to the plastic was given to it by "plasticizers," chemicals which are highly irritable to body tissue if implanted.

The next group of plastics investigated were the polymers of polyethylene. In a recent paper published by the author, the value of polyethylene in reconstructive surgery has been discussed. However, in consideration of soft tissue defects, it was found that whereas the polyethylene is resilient, it does not have sufficient elasticity and softness to be used for soft tissue defects.

Polyethylene sponge was made by heating fine granules on a slab of plaster of paris. Air bubbled through the mass, sponging it. However, although greater elasticity was obtained, it still felt too hard.

Fiberglas in the form of soft wool seemed to offer great promise. In the hand, it is softer than the finest cashmere wool. The authors implanted some of this material in a patient's abdomen. They noted that after a few days, fluid accumulated about the implant.

An artificial rubber plastic known as polyisobutelene offered new hope for a fat substitute. Examination of literature of the manufacturer disclosed that this polyisobutelene contained no plasticizers which would be irritable.

A case history of lipoid dystrophy of the face is presented in which, first, a facial impression was made; then two large pieces of polyisobutelene were shaped to fill the defects and were buried in abdominal fat for a period of 1 month. On removal they were placed in prepared pockets in each cheek. The result was satisfactory in all ways. The face was symmetrical and the patient could smile without looking cadaverous.

In further experimentation with polyisobutelene, the author succeeded in tooling the substance into strands resembling hair. This could be squeezed and pinched only to return to its rounded shape. This was used in 3 cases, in 2 of which a successful result was obtained.

JOHN F. DELPH, M.D.

NECK

Gleanings in the Field of Thyroid Surgery. J. W. LINNELL and J. E. PIERCY. *Lancet*, Lond., 1949, 257: 141.

The authors discuss their observations on thyrotoxic patients at the New End Thyroid Clinic since its establishment in 1932. They report the case of a girl 18 years of age, who had mild symptoms of Graves' disease and who developed a thyroid crisis after a tonsillectomy. They now perform the thyroidectomy first. They report one case of a pigmented malignant papillomatous growth of the thyroid; the gland was infiltrated with a darkly pigmented growth and several pigmented satellites. Thirteen years following removal there was no recurrence.

There were 3 cases of tuberculosis of the thyroid gland (definitely thyrotoxic in 2); the tuberculosis was a surprising incidental finding. The third patient was a man with known tuberculosis and a suspected carcinoma of the thyroid. The gland was tuberculous, with the histologic appearance also of thyrotoxicosis.

Because of extreme exophthalmos, 4 patients have had an excess of orbital fat removed. In one patient a severe cardiac asthma disappeared following thyroidectomy; in some patients asthma has been less severe; in still others the condition is unchanged. One patient with a huge endemic goiter (so large she had to support the gland with a shawl) became toxic and died of congestive heart failure.

The authors have seen several cases of localized pretibial myxedema. In 2 patients the condition followed thyroidectomy; in 1 patient it occurred after the use of thiouracil; and in the others (thyrotoxic patients), prior to surgery. General myxedema did not develop in any of these patients. There is no known treatment that is not serious.

EARL O. LATIMER, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Cerebral Angiography. LYLE A. FRENCH and PAUL S. BLAKE. *Minnesota M.*, 1949, 32: 589.

Although cerebral angiography was first performed in 1927, the procedure did not receive widespread acceptance in this country until after the late war. The development of less toxic dyes has allowed the inclusion of cerebral angiography in the neurosurgeon's armamentarium.

The authors present a review of 100 consecutive angiograms with a concise discussion of the clinical interpretation, technique, indications, and results of cerebral angiography.

With the use of local anesthesia, the authors attempt to inject from 10 to 15 c.c. of 35 per cent diodrast into the common carotid artery percutaneously. If this is not successful, the artery is exposed through a short transverse incision superior to the thyroid cartilage at the anterior edge of the sternocleidomastoid muscle. The closed method is being used in increasing proportions over the open method of injection of the artery. Roentgenograms are taken just before the completion of the rapid injection to visualize the arterial tree. Three seconds later, other exposures are made to demonstrate the venous channels.

The authors state that cerebral angiography is used routinely to ascertain the site of vascular rupture in patients with subarachnoid hemorrhage. The procedure is usually performed 4 days following the hemorrhage so that treatment of the aneurysm may be initiated before recurrent rupture with possible fatal hemorrhage. Angiography is used on patients with suspected brain tumors in whom the site of the lesion is known and in whom the ventriculographic studies are inadvisable or found to be unsatisfactory. In addition, angiography is used in circumstances in which it would be advantageous to know the histological type of tumor or the source of blood supply to the tumor.

A definite differential diagnosis between aneurysm and parasellar tumor can usually be made preoperatively by cerebral angiography. In patients with subdural or extradural hematoma, angiograms reveal vessels to be displaced from the lateral wall of the cranium. Brain tumors may be localized by displacement of normal vessels supplying the brain, enlargement of afferent or efferent vessels in the tumor area, or pathological changes of the blood circulation within the tumor. Both glioblastoma multiforme and metastatic brain tumors have an abundant blood supply which is apparent in the arteriograms, but astrocytomas seldom show any vascularity in either the arterial or venous phase. Meningiomas present a typical picture in that they usually receive part of their blood supply from the external carotid artery, and if this source of supply in the tumor can be shown, it is practically pathognomonic.

Demonstrable evidence of a tumor was present in 62 per cent of 21 patients with verified brain tumor, and evidence of an aneurysm was present in 14 per cent of 42 patients with subarachnoid hemorrhage. Cerebral angiograms were made in 4 patients, and in these cases the vertebral artery was used for injection of the dye. Although it is stated that 50 per cent of the patients experienced disagreeable sensations over the side of the head, with ipsilateral flushing of the face, other possible complications of injection of the common carotid artery with diodrast are not discussed.

JOHN L. BELL, M.D.

Analysis of Electroencephalographic Findings in Cases of Verified Brain Tumor. Electroencephalographic Findings in Malignant Cerebral Gliomas. HENRY M. CUNEO, CARL W. RAND, and H. SJAARDEMA. *Bull. Los Angeles Neur. Soc.*, 1949, 14: 86.

In the first part of this study, the writers presented the electroencephalographic findings in a series of 10 cases of meningiomas arising in the various parts of the cranial vault. Because this tumor is primarily extracerebral in its location, and since its effects on the brain are due to pressure from without, the electroencephalographic findings sometimes show no deviations from the normal, are at times misleading as to localization, and occasionally are helpful in determining preoperatively the seat of the tumor.

In this second part of their study, the authors deal with the common malignant form of cerebral glioma, the glioblastoma multiforme. Nine detailed case reports of glioblastoma multiforme are presented. The symptomatology, neurological findings, laboratory findings, electroencephalographic findings, clinical impression, operative findings, and histopathology are presented for each of the 11 cases reported. Each case is discussed individually. The cases are well illustrated and include visual fields, electroencephalographic reports, photomicrographs of the type of tumors encountered, and a diagram showing the location of the tumor within the substance of the brain. The electroencephalogram accurately localized the tumor in almost 100 per cent of the cases.

The last case discussed was that of a glioblastoma multiforme arising primarily in the corpus callosum. It could not be localized clinically although they knew that the right hemisphere was more involved than the left. Air studies revealed a filling defect in the body of the right lateral ventricle which clearly indicated the site of the tumor. The electroencephalogram in this case showed a bilateral synchrony of the 5–6 c/s slow waves, and it was their impression that this suggested the presence of a deep-seated abnormality in the midline.

HOWARD H. LANDER, M.D.

Prefrontal Lobotomy in Psychiatry (Sulla lobotomia prefrontale in psichiatria). GIACOMO MOSSA and STEFANO TENEFF. *Minerva med.*, Tor., 1949, 1: 939.

The authors have performed prefrontal lobotomy in 25 patients interned for many years in the Psychiatric Hospital of Grugliasco, Turin, in whom no other treatment had provided any durable improvement and of whom 16 had long been reduced to a vegetative life only and were fed by sound. One had frequent and extremely severe crises (hysterical?) of psychomotor agitation for which it was necessary to keep her on a bare metallic framework because of her fury to lacerate everything; another was a chronic melancholic patient with delirious ideas of suicide; and the remaining patients had dissociative forms, 6 of paranoid, 15 of hebephreniac, and 2 of catatonic character. Some improvement which had been obtained with electric shock in a few cases had lasted only one day or a few days.

Three approaches have been proposed to cut the white substance of the two frontal lobes: the lateral temporal approach of Moniz perfected by Freeman and Watts (the high frontal of the American neurosurgeons), and the supraorbital approach with Dogliotti's technique for puncture of the anterior horn of the lateral ventricle. The temporal approach is generally used by most neurosurgeons and can be utilized at various heights. The attempt to obtain interruption of the frontothalamic pathway by injection of alcohol through the supraorbital route must be condemned absolutely because it destroys large zones of cerebral substance, and this dead tissue may easily become a favorable focus for the development of bacteria carried by the needle which has traversed the frontal sinus. To give good results, prefrontal lobotomy must always be bilateral and may be performed in one session without increasing the danger of the intervention. The authors have used the method of Freeman and Watts in which the frontal lobe is reached in its lowest parts, thus avoiding the inferior frontal artery.

The observation period of the patients operated upon is still too short to allow valid conclusions, especially in 2 paranoid and 2 hebephreniac cases in which the present result is excellent. In another 10 patients the improvement can be appreciated fully only in the hospital since they had to be restrained for several years because they reduced their clothes to shreds and plastered themselves with feces or urine every time they were free: they now live in an orderly manner without restraint and feed themselves; some have even resumed some activity and help in cleaning their section or work in the laboratory. One of the catatonic patients responds to questions, smiles, and is interested in her family. In the other patients, very recently operated upon, results are still negative but there are indications of a possible good result, since in some of the previously mentioned cases the improvement came weeks after the operation and has been progressive.

Prefrontal lobotomy has offered no dangers and its postoperative course has been uneventful. However, despite prophylactic penicillin treatment no case has been completely apyretic: the febrile course has been irregular with rises to 38, 38.5, and sometimes 39 degrees C., but without infection or cerebral involvement. In some cases there have been febrile rises more than 8 days after the intervention when the wound was completely healed. This fever must certainly be attributed to the cerebral trauma. No sign of subsequent deficiency has been observed. After the surgical trauma was overcome, some interesting observations were made from the psychopathologic point of view. In 1 patient with extremely vivid hallucinations which compelled her to sit up the whole night on the side of the bed, the hallucinations have persisted in that she still feels that she is being touched in all parts of her body and hears herself called the most opprobrious names (she is a girl from a highly moral family), but she does not get offended any more and sleeps through the whole night. In the schizophrenics the improvement, when there was any, has been especially in the contents, behavior, disposition, instinctive-affective life, not the ideation; in the latter, only the part connected with the dysthymic disturbances was improved. In 1 of these patients there is a mnemic void including the entire period of her illness of 5 years; she remembers in correct order everything that occurred before her illness and everything since the operation when she resumed contact with reality. The authors think that the findings which they are gradually accumulating support Bleuler's doctrine on schizophrenia and Claude's dualistic doctrine.

Patients in whom electric shock had produced some improvement seem to have been more markedly benefited by the operation.

In a case of extreme agitation, the white substance of one lobe had hardly been cut when the patient became calm and it was possible to continue with the operation as in a normal subject.

RICHARD KEMEL, M.D.

SPINAL CORD AND ITS COVERINGS

Acute Traumatic Posterior Dislocation of an Intervertebral Disc, with Paralysis. RICHARD C. SCHNEIDER. *J. Bone Surg.*, 1949, 31A: 566.

The author presents 3 case histories of acute traumatic posterior dislocation of an intervertebral disc followed by paralysis. In the first case there was an acute extrusion of the nucleus pulposus within the thoracic region, followed by a very rapid development of paraplegia. Each of the other 2 patients had acute herniations of a disc in the lumbar region with compression of the cauda equina and immediate paralysis.

A few isolated cases of acute traumatic herniation of an intervertebral disc have been reported. In 1911, Middleton and Teacher presented the case of a man who had lifted a weight, heard a cracking in his back, and was unable to straighten up. Twenty hours later complete paraplegia developed with a sensory level at Poupart's ligament bilaterally, and

the patient died 16 days later. At autopsy, a herniated disc was found between the twelfth thoracic and the first lumbar vertebra, which had compressed and softened the cord.

In 1934 Brooke reported another case of acute complete transverse myelitis, secondary to traumatic herniation of an ossified nucleus pulposus in the cervical region.

Each of the 3 cases is discussed in detail and the surgical findings given.

Unfortunately, there is still a marked tendency on the part of many surgeons to overlook completely, or ignore until too late, those signs and symptoms which are indications for surgery in injuries of the spine and spinal cord.

The early indications for surgery in spinal cord injuries are usually given as: (1) a history of progression of neurological signs; (2) compound fractures of the spine, particularly in those cases with spinal fluid leaks; (3) marked encroachment of bony fragments upon the spinal canal, as exhibited in the roentgenograms; (4) with a lumbar puncture needle in place, evidence of complete blockage of the spinal fluid on jugular compression.

To these, it is believed a fifth indication for surgery should be added, i.e., evidence of blockage of a column of pantopaque upon myelographic examination in those cases which, in spite of a negative Queckenstedt test, have a definite sensory level.

In all of the cases reported in the present article, operation was performed much later than it should have been, and the degree of disability has, at least theoretically, been increased proportionately. These cases should be regarded as surgical emergencies. After early accurate diagnosis, operation should be performed immediately by a competent surgeon, for the elements of the central nervous system do not, in general, withstand prolonged compression without the occurrence of irreversible anatomical changes.

HOWARD H. LANDER, M.D.

PERIPHERAL NERVES

Late Results of Surgical Treatment of Nerve Injuries; 111 Observations (Résultats éloignés du traitement chirurgical des plaies des nerfs; (à propos de 111 observations). P. WERTHEIMER and J. MATHIEU. *Mem. Acad. chir.*, Par., 1949, 15: 387.

A survey of 121 surgical interventions on 111 patients with nerve injuries is submitted by the authors. Two patients either had multiple injuries or underwent several operations. Ninety-two patients sustained the trauma while serving in the army during the war.

In 24 patients a complete anatomic and functional recovery was obtained and in 36 an amelioration of the motor and sensory disturbances, pains, and trophic lesions, while in 49 failure was recorded.

In 37 instances nerve transplantation was employed. In 2 of 10 cases of autotransplantation the results were excellent, in 3 they were good, and in 2 they were poor. In only 1 of 9 cases of homotransplantation an improvement was recorded. In 2 of 18 cases of heterotransplantation a minimal improvement was obtained.

In 44 patients the injured nerves were sutured. This method of repair was employed whenever possible, the nerve trunks being mobilized at some distance from the site of injury, the nerves being transposed, or the distal segment being flexed. The last mentioned method furnished deplorable results. In 12 patients, or 27 per cent of the entire group, the results of suturing the nerves were excellent; partial improvement was noticed in 11 and failure in 21 patients.

In 37 instances neurolysis was employed; recovery was recorded in 10, amelioration in 18, and poor results in 8.

Early intervention furnished the best results. An operation performed later than 6 months after the injury can be expected only to relieve pain or to prevent or cure trophic disturbances.

The authors' observations point to the relative independence of the regeneration of nerves from injuries of the large blood vessels, contrary to the great role which such lesions play in the recovery of muscular function. JOSEPH K. NARAT, M.D.

Occupational Pressure Neuritis of the Deep Palmar Branch of the Ulnar Nerve. JOHN L. BAKKE and HAROLD G. WOLFF. *Arch. Neur. Psychiat.*, Chic., 1948, 60: 549.

Focal atrophic paralysis of the small muscles of the hand without cutaneous sensory disturbances may be caused by a pressure neuritis of the deep palmar branch of the ulnar nerve, and hence must be considered in the differential diagnosis of the amyotrophic lateral sclerosis and musculature atrophy. Although reports in the literature are rare, Ramsey and Hunt in 1908 first recognized this syndrome correctly.

The authors present a case of ulnar paralysis (of rather sudden onset) in a telephone cable splicer without any cutaneous sensory disturbances. A callus was found to overlay the postulated site of nerve injury. This site was distal to the innervation of the hypothenar muscle which was spared, but the muscles supplied by the more distal portion of the nerve, mainly the interosseous, the abductor, and the pollicis muscles, were found to be paralyzed and atrophic.

A most important finding not previously reported or apparently recognized was that the muscles suffered a loss of sensitivity. This was verified by injection of 0.1 c.c. of 5 per cent sterile saline into normal muscles, which produced severe aching pain, whereas the injection of five times that quantity of solution caused no discomfort in the paralyzed muscle. This important but simple procedure is suggested as a means of distinguishing a neuritis from either a myopathy or progressive spinal muscular atrophy, since in the latter cases there should be diminution in the muscular sensitivity.

JACK I. WOOLF, M.D.

Surgical Treatment of Sciatica: Results 3 to 8 Years After Operation. DEAN H. ECHOLS. *Arch. Neur. Psychiat.*, Chic., 1949, 61: 672.

The common painful state formerly called chronic, or recurrent, sciatica is now known to be the result of compression of a nerve root within the spinal canal or its foramen. It is also known that such sciatic pain is due to compression of the root by a diseased intervertebral disc in at least 75 per cent of cases. In the rest, compression of the root is produced by such pathologic conditions as intraspinal tumor or cyst, primary or metastatic tumor of a vertebra, spondylolisthesis, and arthropathy.

The chief point of contention concerns the type of surgical treatment in the case of ruptured intervertebral disc. Many neurosurgeons are of the opinion that the compressed nerve root should be decompressed, that the offending disc should be partially removed, and that spinal fusion should not be performed. On the other hand, an increasing number of orthopedists are advocating some type of internal fixation of the spine at the time of removal of the disc.

Advocates of the combined operation for ruptured disc have extended the indications for the procedure to include such factors as the presence of associated anomalies of the lumbosacral region, unstable spine or arthritis, roentgenographic evidence of pronounced narrowing of the disc, predominance of pain in the back over sciatic pain, occupations requiring lifting and bending, and pain in the back, of long duration. Some have gone so far as to recommend the combined operation for practically all patients requiring surgical removal of lower lumbar intervertebral discs.

The present review is concerned with a follow-up study of 109 patients with ruptured discs treated by partial removal of the disc. In the 109 cases, a followup report was obtained in 75 cases by having the patients return for examination. Twenty-three other patients answered questionnaires, and 3 were known to have died some years after the initial surgery. An unbiased evaluation of the results was obtained by having an independent orthopedist make the follow-up study and he had had no previous contact with this group of patients.

The longest follow-up period was 7.9 years, and the shortest was 2.9 years. The average interval was 5.5 years. Only 57 per cent of the patients attributed their symptoms to a specific injury. Of the discs affected, 51 lesions were of the lumbosacral discs and 50 were of the adjacent disc. There were no cases of rupture of the third lumbar disc; even more surprising is the absence of multiple ruptured disc in this series.

The surgical treatment consisted of decompression of the affected root by unroofing it with chisel or rongeur, removal of the protruding portion of the disc and extensive curettage, and removal of inner portions of the disc. In addition to partial removal of the ruptured disc, section of the sensory fibers of the affected root was performed in 6 cases.

This study did not contribute any worthwhile information regarding the value of myelography, for it was discontinued as a routine diagnostic procedure about January 1, 1941.

The functional results were tabulated as excellent, satisfactory, or unsatisfactory. Results were considered excellent when the patient was in complete agreement with the examiner that there was no disability resulting from the original pain in his leg or back or from the operation performed. Results were classed as satisfactory when the patient, in spite of minor difficulty with his back or leg, returned to working full time without disability. The results were unsatisfactory when the patient could not work full time because of persistence or recurrence of pain in the back or leg.

Six patients in whom results were excellent or satisfactory were relieved of their symptoms in from 12 to 66 months after operation and then were operated on a second time for recurrence of pain in the back and leg; 3 patients had sciatica on the opposite side owing to rupture of an adjacent disc; 2 had sciatica on the opposite side owing to another nodule on the same disc, and 1 patient had recurrence of the original sciatica because of adhesions which compressed the root, and was treated by rhizotomy. All 6 patients were restored to the classification of satisfactory or excellent results and have remained in the same classification for periods ranging from 6 to 68 months.

Ninety-one per cent of the patients were classified as having a good result because they were working full time without disability and with no more than minor complaints referable to the back and leg. Seven patients, or 9.33 per cent, had unsatisfactory results.

A total of 17.8 per cent of the patients operated upon were classified as compensation cases. In this group, excellent or satisfactory results were obtained in 78 per cent and unsatisfactory results in 22 per cent.

About 9 per cent of the patients were reoperated upon for a recurrence of symptoms. If this deduction is correct, the incidence of recurrence following removal of a ruptured disc can be set at about 10 per cent.

Since the results of operation for removal of a ruptured disc are so satisfactory in carefully selected cases, the combined operation would seem to be contraindicated, except in unusual circumstances.

HOWARD H. LANDER, M.D.

SYMPATHETIC NERVES

Results of Treatment of Patients with Hypertension by Total Lumbar Sympathectomy, Splanchnicectomy, and Celiac Ganglionectomy. KEITH S. GRIMSON, EDWARD S. ORGAIN, BANKS ANDERSON, ROBERT A. BROOME, JR., and FRANK H. LONGINO. *Ann. Surg.*, 1949, 129: 850.

Total thoracic and partial to total lumbar sympathectomy, splanchnicectomy, and celiac ganglion-

ectomy were carried out in the majority of 113 hypertensive patients. Major complications of hypertension were often present before operation and included: hemiplegia in 19 patients, hypertensive retinopathy in 49, decrease in renal function in 9, cardiac enlargement in 15, and abnormal electrocardiograms in 65 patients. Myocardial infarction and elevation of the nonprotein nitrogen were considered contraindications to operation. In this series, patients were selected for operation when recommended by a majority opinion of consultants following failure of a favorable course under medical management for periods of usually more than 1 year. The average age of the group was 36 years, and there were 46 males and 67 females. The two-stage operation is extensive but is concisely described.

To determine the extent of denervation early and late after operation, neurodermometer studies and iodine starch tests were performed in many instances. It was found that the average body surface denervated in 21 patients soon after sympathectomy was 77 per cent. As the time interval lengthened, recovery of the ability to sweat occurred in irregular patches, usually on the trunk and legs. Horner's syndrome occurred bilaterally and usually persisted. A definite reduction in the heart rate remained following operation up to periods of 7 years.

Classed under operative mortality were 4 deaths, 3 of which occurred among the first 19 patients. Only 1 death attributable to operation occurred among the remaining 94 cases. Ninety-seven of the original 113 patients were living from 1 year to 8½ years following operation.

A postural hypotension, with few exceptions, persisted during periods of observation as long as 8½ years. This was not associated with tachycardia since the heart and the suprarenal glands were denervated. With supine recordings, 31 patients had reductions of the blood pressure to near normal, 43 patients had reductions, but not to normal, and 23 patients had no significant change in the blood pressure following operation.

In cases in which pre-existing symptoms occurred after operation, they were much less severe. The number of patients relieved was greatest in the group with the most reduction of blood pressure. Precordial pain and palpitation were abolished since the operation interrupted both nervous pathways conducting pain from the heart and the sympathetic cardiac accelerators.

The effect of sympathectomy upon hypertensive retinopathy, grouped according to the effect on blood pressure, is presented as well as the effect on renal function and cardiac enlargement. Electrocardiographic studies of the results of the operations demonstrated little effect. Four patients became pregnant following the procedure and each case is briefly described. Hypertension recurred at some time during the pregnancy in each of the patients.

Some of the complications of total sympathectomy are discussed. Of these, the most serious has been pain, which occurred in all patients and lasted occasionally as long as a year. Symptoms of dizziness when standing rarely persisted a year. Partial obstruction of the nasal passages was a troublesome symptom because of swelling of the mucous membranes.

In conclusion, the authors state that near total sympathectomy apparently retarded, and even arrested the hypertensive disease process in the majority of the patients who were observed.

JOHN L. BELL, M.D.

MISCELLANEOUS

Survey of the Value of Neurosurgical Treatment for the Relief of Intractable Pain. MICHAEL SCOTT and HENRY T. WYCIS. *Am. J. Surg.*, 1949, 77: 718.

Scott and Wycis have reviewed in some detail the various procedures which can be carried out by the neurosurgeon for the treatment of intractable pain. These consist of: bilateral prefrontal lobotomy with its various alterations such as unilateral section; resection of the sensory cortex; thalamotomy; spinothalamic tractotomy in the mesencephalon, medulla, or cord (cordotomy); posterior rhizotomy; peripheral nerve neurotomy; sympathectomy; injections; and other additional minor procedures.

The author has illustrated treatment by most of these various procedures by his own case histories. Altogether, his review covers 57 cases of intractable pain in which 62 neurosurgical procedures were done. He believes that about 60 per cent of his patients had complete relief, 17 per cent partial relief, and that 23 per cent were unrelieved. Twenty per cent of his patients had temporary motor weakness and bladder dysfunction, and 18 per cent of his patients had annoying chest pain, probably root pain from local manipulation after cordotomy, which findings were reported by many other neurosurgeons.

He had distressing results in a small group of patients following section of the fifth and ninth cranial nerves and the upper three cervical roots in the treatment of the nasopharyngeal malignancy. He believes that in such patients lobotomy is probably the procedure of choice. It did seem that paravertebral malignancies are best treated by rhizotomy or cordotomy alone or in combination, and that cordotomy is the proper procedure for the intractable pain of abdominal or pelvic malignancy. He believes that dorsal preganglionic sympathectomy is the best method for relieving causalgia of the upper extremities.

JOHN MARTIN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Benign Tumors of the Breast. HARRY C. SALTZSTEIN and ROBERT S. POLLACK. *J. Am. M. Ass.*, 1949, 140: 997.

The present report is concerned with a statistical analysis of 100 consecutive patients exhibiting benign lesions of the breast. Chronic cystic mastitis was the most commonly observed condition in the 100 cases of benign disease of the breast. It is a disease which involves all of the mammary tissue and is characterized by a varied histological picture. Local excision, the treatment of choice, is not curative, but is the only certain method to rule out the presence of cancer, whose relationship to chronic cystic mastitis is still the subject of debate.

Adenofibromas occur predominantly during the child-bearing period. Accurate diagnosis in these patients is more readily obtained than with other tumors of the breast. Because of the rapid increase in size of these tumors during periods of estrogen stimulation, and the possibility of their malignant transformation, early excision is important.

Bleeding from the nipple is a cardinal symptom of papillomas of the duct system. Accurate localization is necessary in the surgical treatment of these tumors. When this has been accomplished and the benign nature of the lesions has been verified, local excision is the only treatment necessary.

A somewhat heterogenous group of tumors was found in the remainder of 100 patients with benign conditions of the breast. These included lipomas, abscesses, fat necrosis, and aberrant breast tissue. All of them are noncancerous, but are of diagnostic importance and cause much worry and anxiety to the patient.

ORVILLE F. GRIMES, M.D.

Hidden Carcinoma of the Breast. HOWARD D. COGSWELL. *Arch. Surg.*, 1949, 58: 780.

The author reports a case of carcinoma of the breast, not detectable by physical examination, in which the diagnosis was made by biopsy of an enlarged axillary lymph node. Only 3 similar previously reported cases have been found in the literature.

A woman of 45, recently recovered from a virus infection of the respiratory tract, was first seen complaining of an enlarging mass in the left axilla with pain of the left arm. Physical examination revealed a tender, hard, somewhat immobile node in the left axilla that did not seem to be attached to the skin. No other enlarged lymph nodes were found elsewhere. The breasts were normal. On removal of the left axillary node, metastatic adenocarcinoma was found. A radical left mastectomy was performed, and gross examination of the breast revealed a 9 mm. nodule situated 7 cm. below the nipple at the lower border of the breast. This nodule was stony hard and coarse. Several nodes were present in the axillary fat, the largest of these measuring 2.5 cm. in diameter. Microscopic examination confirmed the diagnosis of adenocarcinoma of the breast with axillary metastases.

The 5 groups of axillary glands with their afferent vessels drain the arm, the skin, and muscles of the anterolateral wall of the body above the level of the umbilicus, the skin and muscles of the dorsal aspect of the trunk, the lower portion of the back of the neck, and the central and lateral parts of the mammary gland. Metastasis to the axillary nodes seems, then, to arise from a primary tumor in this region, although a case of metastasis secondary to carcinoma of the liver has been reported. Radical mastectomy is recommended in the presence of axillary metastasis when no other primary site can be determined. This type of carcinoma of the breast is similar to hidden primary tumor of the thyroid discovered by the presence of secondary "aberrant" tumors in the neck.

The author emphasizes the importance of thorough palpation of the axillae in all examinations of women.

In the discussion of this article, 3 similar cases were reported. Also reported were several cases of unusual metastasis from breast tumor, and 2 cases of carcinoma of the breast, the only sign of the condition being a discharge from the nipple.

JACOB T. BRADSHER, M.D.

Evaluation of Principal Mammaplastic Procedures. JACQUES W. MALINIAC. *Plastic & Reconstr. Surg.*, 1949, 4: 359.

The author believes that every mammaplastic procedure embraces three main steps: (1) the shaping of skin flaps; (2) the formation of glandular pedicles; and (3) mastopexy. Equally important, it must include planning for symmetry and sculptural appreciation of normal form. In shaping the skin flaps and creating the glandular pedicles, success depends in large measure on preservation of the blood supply. Because in 55 per cent of cases the thoracic lateral artery plays an equal part with the internal mammary artery in the vascularization of gland and nipple, and in 13 per cent it has a predominant role, excision of the external half of the breast is contraindicated.

It is possible to preserve the function of the breast in mammaplasty if glandular resection is carried out distally from the center, without approaching the nipple closely. Peripheral crescent-shaped excision from the lower quadrants, and resection from the external aspect also avoid injury to the galactophore ducts.

The form of the breast should be determined by that of the reconstructed gland. Firm affixation of the breast to the pectoral muscle is indispensable to a good end result. The hypertrophic breast may con-

ceal or foreshadow a variety of lesions such as fibroadenomas, intraductal papillomas, and cystic mastitis. Hence, the removal of all pathologic tissue may reasonably be considered a prophylactic as well as cosmetic measure. The value of endocrine therapy in most cases of chronic cystic mastitis, however, should not be ignored.

The choice of a mammaplastic procedure depends on the morphologic and histologic character of the breast. No one surgical method is suited to all cases. On the basis of the standard enumerated, all procedures based on skin excision alone must be rejected. Three basic methods challenge comparison: (1) glandular resection without transposition of nipple; (2) transposition with or without resection of the gland; and (3) amputation of the gland (total or subtotal) with free grafting of the nipple.

The author employs a two-stage technique for hypertrophies requiring extensive glandular excision which not only safeguards the blood supply but permits adequate attention to fine morphologic details.

At the first stage, the nipple and areola are detached from the surrounding skin by a superficial circular periareolar incision; the dissection is carried out intradermally to preserve the important arterial and venous plexuses. An anterior skin flap is then outlined by means of a horizontal supra-areolar incision extending between the ends of submammary fold. Sufficient subcutaneous tissue is retained on the flap to ensure healthy vascularization. Its dissection is extended bluntly toward the second intercostal space to permit upward displacement of the gland and a limited wedge-shaped excision is carried out from the central segment of the upper half of the gland. Dermal loop secures fixation to the pectoral muscle. After the "take" of the transposed gland is assured (4 to 6 weeks), the necessary resections are carried out in the lower quadrants and along the external aspect. The skin covering is shaped in a double flap along an inverted T-shaped incision.

In prolapsed breasts with a normal or atrophic gland, where no glandular excision is required, the procedure can be carried out in one stage. To ensure proper location of the nipple, fenestration should always follow shaping and affixation of the gland. The latter must usually be tightened up to give the breast the desired cone shape.

In true hyperplasias in which the breast attains extreme proportions, in massive hypertrophies in women past the reproductive period, or in the presence of diffused nodular cystic mastitis which may foreshadow malignant degeneration, subtotal mammectomy with free grafting of nipples has been advocated. The normal tactile and erotic sensibility of the freely grafted nipple, however, is lost.

STEPHEN A. ZIEMAN, M.D.

Effects on the Breast of Removal of the Nipple or Severing of the Ducts. HERBERT H. DAVIS. *Arch. Surg.*, 1949, 58: 790.

The author seeks to answer whether retention of secretion caused by removal of the nipple, or obstruction of the mammary or lactiferous ducts (or both) is dangerous as regards the later development of inflammation, galactocele formation, or carcinoma of the breast. He also seeks to determine the effect on the breast of later occurring pregnancies and lactation, and of stasis in the lactiferous ducts caused by absence of the nipple or obstruction of the mammary ducts.

His conclusions are based on animal experiments and clinical experiences of several authors, plus his own experience with removal of the nipple in 1 case, and with operative treatment for benign lesions of the breast in 24 cases.

The animal experiments reviewed consisted of 4 separate investigations on mice and rats. They involved ligation or sealing of the mammary ducts of female mice and rats and subsequently breeding them. Rapid breeding and prevention of suckling without closing the mammary ducts were also observed. These experiments were interpreted as showing that stasis of secretion in rats and mice as a result of nonsuckling of the young is a prominent feature in causing mammary carcinoma, and it is considered probable that the chemical irritation of retained mammary gland secretion may bear a causative relationship to tumor of the mammary gland in female mice and rats.

A report of 200 cases of carcinoma of the breast in adult female patients showed a preponderance of either no nursing history or an abnormal nursing history as compared with a control group of 100 patients without breast cancer. In addition, the control group showed a lower incidence of abscess formation, inverted nipple, caked breast, and miscarriage. From these studies, it is believed that stagnation in the mammary ducts apparently increases the incidence of carcinoma of the breast.

The report of a Mayo Clinic group on 204 cases of comedomastitis (dilation of the lactiferous ducts, distended with inspissated grumous material) shows that neoplasia is not related to comedomastitis etiologically. By simple obstruction of the mammary ducts, neoplastic changes may at times produce comedomastitis.

With regard to the 1 case in which the nipple of the left breast had been excised for a nonspecific lesion, the author states that 15 years after the operation no abnormalities have been detected, and the patient has been through 2 pregnancies without difficulty.

Of the 24 patients who were operated upon for centrally located cysts and benign tumors of the breast, 22 had no trouble, 1 patient noticed a small lump which had been present for 3 years but was not enlarging, and 1 noticed the development of a lump that disappeared after a time. No carcinoma was detected in the period during which these women were observed.

Although experiments in mice and rats tend to show that closing the nipple may cause carcinoma in the underlying breast, the experiments have been done in strains with a high incidence of mammary

cancer. From reports in the literature, there is evidence that obstruction of the nipple in the human may cause stagnation, chronic inflammation, and comedomastitis. Definite proof that carcinoma may result is lacking. No definite conclusion could be drawn about the results of removal of the nipple or severing of ducts. JACOB T. BRADSHER, M.D.

TRACHEA, LUNGS, AND PLEURA

Tracheal Tumors in Infants and Children. JOSEPH G. GILBERT, BENJAMIN KAUFMAN, and LAURENCE A. MAZZARELLA. *J. Pediat.*, S. Louis, 1949, 35: 63.

The authors present 2 cases of angiomatous tracheal tumors, both in 11 months old infants. A review of the literature revealed 39 cases of tracheal tumors in infants and children (exclusive of their own cases). Of these, 56 per cent were papillomas, 30 per cent were fibromas, and 10 per cent were angiomas; malignant sarcomas occurred in 3 children. These tumors usually appear in the upper third of the trachea. They may cause symptoms by interference with action of the vocal cords (hoarseness), or by partial obstruction of the main stem bronchi or trachea with wheezing, dyspnea, and atelectasis. Diagnosis is made by bronchoscopy and lateral roentgenography of the neck. Differentiation from laryngeal cysts and papillomas is made by direct laryngoscopy. Congenital laryngeal stridor in which the epiglottis and aryepiglottic folds are pulled into the larynx on inspiration can be ruled out because the "crowing" is inspiratory, worse on activity, and gradually disappears with age. Therapy consists of endoscopic removal with apparent good results. WILLIAM K. WRIGHT, M.D.

The Segmental and Lobular Physiology and Pathology of the Lung. EDWARD D. CHURCHILL. *J. Thorac. Surg.*, 1949, 18: 279.

The author points out the fact that another chapter in pulmonary surgery awaits development, i.e., the segmental and lobular physiology and pathology of the lung. He states that the bronchopulmonary segment with its component lobules is a physiologic as well as a surgical unit of the lung.

Increasing tissue pressure in the extremities assists in the control of filtration edema. However, conditions different from these exist in the pulmonary tissue where fluid escapes into the alveoli and can be effective only when consolidation occurs. Also, this leakage into the alveolar spaces is destructive to the function of the lung. Obstruction to the outflow of air to a single area may be due to a valvelike fold of mucous membrane or other "ball-valve" mechanisms. The neuromuscular apparatus appears to be concentrated in the bronchial tree. The bronchi undergo inspiratory dilatation with lengthening and expiratory constricting with shortening. There is little or no stretching in the walls of the alveoli. The bronchial musculature forms sphincters about the openings into the atria which may result in trapping of air in the alveoli.

The sequence of events in the cough mechanism is described as follows: (1) inspiratory widening of the terminal bronchioles; (2) early in expiration, the quick closure of the laryngeal sphincter with elevation of endobronchial air tension by the muscular effort of a cough or grunt; (3) trapping of air in lobules under increased tension; (4) slow reduction in tension by collateral air drift through the pores so that on the next cough the lobule receives a blast of fresh air with renewed oxygen supply.

In World War II, localized pulmonary edema from direct trauma was treated by clearing the upper passages, by intercostal nerve block, and by plural aspiration when indicated. Morphine and tight strapping were omitted. As a result there was a marked diminution in the wet massive collapse of the lung seen in World War I.

The level of action for mechanisms that control ventilation and alveolar air tension seems to be at the bronchiole, the site of the sphincters. At the level of the segmental bronchus a secreting membrane is well developed and is a factor in obstruction. Obstruction here results in filling or drowning of the bronchioles and air sacks by secretions. The question of total, versus segmental, control of secretory activity remains unanswered.

Some segments of the lung remain distended as a result of collateral air drift even when the bronchiole to this segment is obstructed. This air is trapped air and is devoid of function because it has reached an equilibrium with the capillary bed.

Cases in which lobes were removed are presented, with roentgenograms of lobes injected with lipiodol, to demonstrate this phenomenon.

Respiratory function depends on active capillary circulation, not on capillaries containing blood. The structure of the lung maintains spatial integrity despite serious functional deterioration resulting many times in complementary emphysema. The lungs must be considered as a highly integrated organic system and must be studied from this point of view. ROBERT E. FLORER, M.D.

Decortication in Pulmonary Tuberculosis, Including Studies of Respiratory Physiology. JOSEPH GORDON, RAY BROOK, and EDWARD S. WELLS. *J. Thorac. Surg.*, 1949, 18: 337.

The authors present a study of the applicability of decortication to the inexpansible tuberculous lung. They state that the problem of hemothorax and pyothorax, with or without the presence of air, is not entirely comparable with that of the inexpansible tuberculous lung and empyema. In the former the pleural complication is the end point, while in the latter the pleural problem is secondary to parenchymal disease which is the chief consideration. In certain cases thoracoplasty sacrifices good functioning lung tissue. In some cases re-expansion is harmful to the diseased lung tissue; in others, the lung tissue is expanded but function is not improved.

The maximum breathing capacity, lung volume, bronchospirometry, arterial blood gases (at rest and

during exercise), and the metabolic and respiratory response to exercise were studied in 9 cases.

The removal of the visceral peel was relatively easy in all patients but one who had a 27 year history of tuberculosis. Areas which were most adherent because of underlying disease were circumvented. There were no complications following this procedure; there was no case of contralateral spread; there were no recurring empyemas and all wounds healed primarily. Streptomycin was used preoperatively and postoperatively.

The condition of the re-expanded lung is discussed. It may be ventilated with poor circulation, or inventilated with good circulation. A certain lapse of time may be necessary before maximum function is obtained. Whether or not to remove the parietal peel is as yet unknown.

The case presentations are complete with roentgenograms and discussions.

Decortication is suggested for longstanding inexpansible pneumothorax, persisting hydrothorax or pyopneumothorax which fails to respond to other measures, re-expansion of contraselective collapse of a healthy lung, in pleurocutaneous fistula with residual pleural space instead of a Schede operation (possible in the presence of a bronchopleural fistula also). Improvement in function in tuberculosis is not as satisfactory as in uncomplicated cases of hemothorax or pyothorax. ROBERT E. FLORER, M.D.

Congenital Cystic Disease of the Lung in Infants and in Children. MARK M. RAVITCH and JANET B. HARDY. *Arch. Surg.*, 1949, 59: 1.

Twelve patients suffering from cystic disease of the lungs are presented. They varied in age from 13 weeks to 13 years.

Some degree of infection was found in each case.

Eleven of the 12 patients were successfully treated by surgical removal of the involved area of lung (6 single lobectomies, 4 lobectomies of two adjacent lobes, and 1 pneumonectomy).

The single death, from pneumonia, occurred in an infant of 8 months for whom operation had been deferred and was not performed.

Among these 12 patients, 2 were found to have cysts associated with anomalous lobes of the lung, in each instance a trilobed left lung; 1 of these had an anomalous arterial blood supply derived from the aorta. A third patient had an anomalous systemic artery entering a cystic lower lobe of the right lung.

Resection of the cyst or of the cyst-bearing segment of lung is the recommended treatment.

Detailed histories and illustrations are given.

JOHN J. MALONEY, M.D.

HEART AND PERICARDIUM

Fate of Cardiac Foreign Bodies. JAMES M. FRITZ, MELVIN M. NEWMAN, ROBERT W. JAMPOLIS, and W. E. ADAMS. *Surgery*, 1949, 25: 869.

Experiments were carried out by opening the chests of dogs and implanting, in and about the heart, irregularly shaped pieces of metal, cast iron, or brass resembling bomb or grenade fragments.

A total of 62 dogs were used, only 3 of which died as a result of the foreign body; embolism and occlusion of a systemic artery occurred in 2 dogs, and infection in 1 dog.

Foreign bodies introduced into the pericardium produced minimal local reaction and were well encapsulated after a period of 8 weeks. Pain in animals is hard to evaluate.

Only 3 of the 35 foreign bodies introduced directly into the chambers of the heart remained within the heart. Apparently these had been mechanically caught between chordae. No untoward findings were noted in these 3 cases.

The remaining 33 foreign bodies were quickly embolized to the pulmonic or systemic circulation. Those embolized from the right heart lodged in the primary pulmonary artery to a more dependent lobe. Only rarely was an infarct produced. Those embolized from the left heart lodged for the most part at the bifurcation of the aorta. The site of their lodgment in the systemic circulation apparently was due to the proportionate size of the foreign body.

Of the 18 foreign bodies placed in the myocardium, only 2 caused serious results—because of infection in one dog, and because of concomitant extensive infarction of the myocardium (due to injury to the coronary artery at the time of surgery) in another. The other 16 foreign bodies caused only minimal local reaction and were firmly encapsulated in a fibrous scar after 8 weeks. Indeed, the removal of these foreign bodies from the myocardium was accomplished rather by additional myocardial damage. There were no cases of migration of the foreign body from the myocardium into the chamber of the heart.

On the basis of these experiments, the authors think it seems reasonable to conclude that the majority of foreign bodies retained in or about the heart, so long as they are not producing symptoms or signs of cardiac dysfunction, may be permitted to remain undisturbed. They do not believe that it is necessary to remove such foreign bodies for prophylactic purposes. JOHN J. MALONEY, M.D.

ESOPHAGUS AND MEDIASTINUM

Dysphagia and Extraesophageal Pathology. Clinical Review of Some of the Important Surgical Lesions from the Endoscopic Viewpoint. W. K. HART. *Laryngosope*, 1949, 59: 771.

In anatomical order, the authors discuss extraesophageal lesions which are of interest to laryngologists and surgeons. They present, first, a case of pharyngeal-esophageal diverticulum, and describe it as a herniation of the mucosa and submucosa of the hypopharynx between the inferior constrictor of the pharynx and cricopharyngeus. It is commonly seen on the left side, but may occur on the right, or on midposterior or midanterior lines; it is called the pulsion type of diverticulum in contradistinction to the traction type of true esophageal diverticulum

found as low as the level of the crossing of the left bronchus. This lesion can be treated by means of a one-stage operation with adequate chemotherapy. In the presence of other pathologic changes, a two-stage Lahey operation is advocated.

In highly obstructive esophageal lesions, tube feeding may be introduced before, during, or after operation, under direct vision, if essential.

The second case considered was that of a superior mediastinitis originating in an abscess in a retropharyngeal location. Incision and drainage, tracheotomy, and generalized supportive treatment was administered.

Two cases of hiatus hernia are presented and discussed. In general, these diaphragmatic hernias may develop on either a congenital or traumatic basis, but usually the former. The usual locations are through the hiatus pleuroperitonealis (foramen of Bochdalek), through the dome, the esophageal hiatus, the foramen of Morgagni, or through a gap left by absence of the left diaphragm. The hernia may be paraesophageal in type, with an essentially normal esophagus, or the latter may be shortened so that the lower esophagus and a portion of the stomach is above the diaphragm. Dysphagia with obstruction usually is the presenting symptom in these cases and there is nearly always a degree of periesophagitis.

The authors attempt to distinguish carcinoma of the cardia and cardiospasm by pointing out that the endoscopist should be suspicious of cancer if the following conditions prevail: (1) firm resistance to introduction of the endoscope; (2) if a dilating bag cannot be introduced over a previously swallowed thread; (3) failure of supposed spasm, without angulation, to respond to dilation.

JANE C. MACMILLAN, M.D.

Surgical Management of Instrumental Perforation of the Esophagus. J. DEWEY BISGARD and H. HARPER KERR. *Arch. Surg.*, 1949, 58: 739.

The authors give support to the belief that instrumental perforation of the esophagus that is not promptly and properly treated is usually fatal. Perforations of the esophagus in general are discussed. Five cases of instrumental perforation are reported.

Perforations are classified as resulting from either intrinsic or extrinsic causes. The intrinsic causes are given as: tumors arising from the esophagus, esophagitis, spontaneous perforation (as from violent vomiting), and ulceration. Extrinsic causes are instrumentation, swallowed foreign bodies, penetrating wounds, penetration of extrinsic neoplasms, penetration of extrinsic infections, aortic aneurysm, ulcerations due to swallowed caustic, and indwelling gastric tubes.

According to the clinical etiologic factors, the perforations may be slowly perforating lesions (erosion of tumors and some foreign bodies), minute perforations as by pins and fish bones, and gross immediate perforations from instrumentation, penetrating wounds, and spontaneous rupture. In the first two of these clinical groups the infection tends to remain localized or, in the majority of cases, to spread slowly. In the third group, soiling takes place immediately.

The route of spread of soiling following perforation varies according to the site: those in the proximal portion of the esophagus spread throughout the retrovisceral space and superior mediastinum; those in the distal half extend through the posterior mediastinum and, occasionally, to the pleural cavities.

The pain of sudden perforations is localized first to site of perforation, but rapidly spreads and increases with swallowing and with respiratory movements. Perforations of the distal esophagus are soon followed by cyanosis and shock, and the respirations are grunting, rapid, and shallow. According to the site of perforation there develops in minutes to hours a cervical emphysema.

The roentgenographic findings in cervical perforations show early mottling of air scattered in the retrovisceral space. Air is also visible in the lateral planes of the neck with evidence of space between the esophagus and vertebral bodies.

Instrumental perforations are most common during esophagoscopy when the esophagus may be torn at the levels of narrowing, in the process of removing a foreign body, or in taking a biopsy. By reports, the gastroscope is the next most frequent cause of perforation, and dilation of strictures is the third most common cause.

The mortality is greater the longer the delay before surgical intervention. Immediate treatment should begin once the diagnosis is established, and consists of management of shock followed as soon as possible by exposure of the site of perforation and establishment of free drainage. The cervical portion of the esophagus is approached through an incision along the anterior border of the sternocleidomastoid muscle. The superior mediastinum can be drained through this incision, but a dorsal mediastinotomy may at times be preferable. The posterior mediastinum is approached paravertebrally through a lower dorsal mediastinotomy or transpleurally through a thoracotomy. It is desirable to close the perforation, since even temporary stoppage is beneficial.

Penicillin and streptomycin are given in large doses. Nothing is given by mouth until the perforation is closed or a walled-off sinus tract is established. In perforation of the cervical portion, the head-down position is maintained. In thoracic perforations the sitting position is used. An esophageal fistula usually occurs, which closes promptly and heals without stricture.

In 3 of the cases reported, the cervical esophagus was involved, and perforations occurred during esophagoscopy (during introduction of the instrument in 2 cases and in an unsuccessful attempt to remove a foreign body in 1 case). Surgical drainage was carried out immediately in one case and this patient recovered; the other 2 patients died, 1 without surgical intervention, and 1 after drainage and tracheotomy performed 2 days after perforation.

In the 2 remaining cases, there was involvement of the thoracic esophagus. In 1 of these, perforation occurred during an attempt at dilatation by a bougie and in the other, by a catheter stretched over a wire stilet. The first patient developed a mediastinal abscess with rupture into the pleural cavity. The pleural space was drained and gastrostomy was performed. The other patient was treated conservatively. Both patients recovered.

In 3 cases esophageal diverticula were demonstrated either preoperatively or postoperatively.

JACOB T. BRADSHER, M.D.

Esophageal Resection with End-to-End Anastomosis: Experimental and Clinical Observations. EDWARD F. PARKER and WILLIAM S. BROCKINGTON. *Ann. Surg.*, 1949, 129: 588.

Resection of approximately 33 per cent of the lower half of the thoracic esophagus with restoration of the continuity by end-to-end anastomosis was performed on 21 dogs without the use of adjunctive therapy. The mortality in the dogs was about 33 per cent regardless of the side of approach or of variations in the technique. The cause of death in the majority of the 7 animals that failed to survive was infection due to partial or complete disruption of the anastomosis. In only 1 animal was there evidence of lack of a blood supply to the proximal and distal ends of the esophagus after complete separation and dislocation of the thoracic esophagus from its mediastinal bed.

Among the 14 animals that survived and were sacrificed at intervals of from 2 weeks to 8 months following operation, the esophagus was essentially normal. In only 1 animal was there a slight stricture at the site of the anastomotic scar.

The application of the operation as a palliative procedure in 2 cases of inoperable carcinoma of the esophagus is described. In the first case, a primary carcinoma of the lower thoracic esophagus, the operation was successful temporarily in that the ability to swallow was restored for a period of 3 months prior to recurrence. In the second case, a secondary carcinoma of the upper thoracic esophagus, the operation was a failure because of partial disruption of the anastomosis and the development of an esophagotracheal fistula in the presence of a contiguous carcinoma of the trachea.

The operation may have a place in the treatment of selected cases of inoperable carcinoma of the esophagus as a method of palliation superior to others in use at present. SAMUEL KAHN, M. D.

Carcinoma of the Thoracic Esophagus. A Discussion of Early Diagnosis and Surgical Treatment. LYMAN A. BREWER, III, and FRANK S. DOLLEY. *California M.*, 1949, 71: 97.

Esophageal carcinoma comprises 5 to 10 per cent of all carcinomas in males, being surpassed in frequency by carcinoma of the stomach, lung, and rectum. In spite of the great surgical advances made in the past decade, the percentage of resectable carcinomas remains at about 28 to 30 per cent of explored cases. The authors discuss the early diagnosis and management of carcinoma of the esophagus by assuming that in most cases it is possible to make the diagnosis early enough to permit surgical extirpation.

Dysphagia is the most important symptom, and is present in 71 to 100 per cent of the cases reviewed; however, it may not be progressive, and during periods of remission, when the patient swallows better, both physician and patient may be lulled into false security by thinking it is "nervous stomach" or cardiospasm. Belladonna should not be used until accurate diagnosis is made because it reduces the spasm associated with carcinoma, thereby increasing the delay in recognition. Unfortunately, the carcinoma may be large enough to obstruct the esophagus with only mild symptoms of dysphagia; therefore it behooves both patient and physician to be wary of this symptom.

Loss of weight varying from a few pounds to 50 pounds is common, with an average loss of about 20 pounds by the time the patient comes to the surgeon. The weight loss is due more to the inanition associated with the lesion than to metastases.

Regurgitation of undigested food (without bitter or sour taste) has been reported in about half of the cases, as was also vague epigastric symptoms, erroneously thought of as referring to stomach trouble.

Physical findings show typically a starved, elderly male with chronic malnutrition. The x-ray picture outlined by the ingestion of a thick barium meal is pathognomonic. There is irregularity in contour of the lumen at the site of constriction; some dilatation of the esophagus may be seen proximal to the lesion. In one third of the authors' series the referring physician asked for a roentgenological study of the stomach with little attention being directed to the actual site of growth.

Roentgenologically, it is not easy to distinguish spasm from a benign lesion, and spasm associated with carcinoma from an intact overlying mucosa.

Esophagoscopy is the second diagnostic maneuver, during which the lesion may be viewed directly, biopsied, and its fixation noted. Thus is obtained one of the few preoperative clues for the surgeon as to the magnitude of the operation to be planned.

The authors emphasize that with the parental feeding and supportive measures available today, age and malnutrition are not contraindications to operation. Widely accepted contraindications to exploration are evidence of enlarged mediastinal nodes, palpable cervical nodes, enlarged liver, peritoneal involvement, hoarseness due to recurrent laryngeal nerve involvement, persistent fever of over 100 degrees with boring pain, also lesions of aortic arch level showing tracheobronchial involvement with bronchoscopy.

In conclusion, the authors discuss the surgical treatment and general results to be expected from operation, and add a final indicative note that x-ray therapy offers no help in the treatment of carcinomatous lesions of the esophagus.

JANE C. MACMILLAN, M.D.

Surgery of Cancer of the Esophagus (Chirurgie du cancer de l'oesophage). P. SANTY and P. MAILLET. *Mem. Acad. chir.*, Par., 1949, 75: 189.

The authors state that up to the beginning of 1948, they had performed 83 thoracotomies for cancer of the esophagus or of the cardiac end of the stomach. Seven of these were purely exploratory, and the 76 others consisted of 40 total removals of the tumors, and 36 cases of palliative anastomoses.

There were 12 deaths after 40 radical operations which gave an operative mortality of 30 per 100. Two of the deaths on the fourteenth and sixteenth postoperative days, respectively, were the result of disunion of the anastomosis in high-lying lesions; the third death, also in a patient with a tumor in the upper third of the esophagus, occurred on the sixth postoperative day after 3 days of high intestinal obstruction. It was possibly due to injury of the pneumogastric nerve at operation. The next 3 deaths occurred following operations on the lower part of the esophagus or the cardia.

The group of 34 patients with lesions of the lower esophagus and cardia presented 9 deaths as follows:

One death after 11 gastrectomies (total) with esophagojejunal anastomosis.

Three deaths after 10 esophagogastric resections with anastomosis of the base of the stomach and esophagus.

Four deaths after 13 esophagectomies without gastric resection.

One death in a patient with a tumor of the cardia and an old gastric ulcer.

The authors discuss the special technical difficulties present with megaesophagus, pulsion diverticulas, and hiatus hernia lesions associated with cancer. They also describe a peculiar primary and secondary "shock" they have seen associated with their operative mortalities. They state that they use a liter of blood for transfusion in the resections and 500 c.c. in the palliative anastomoses.

These surgeons have done 36 of these palliative anastomoses, which are essentially short-circuiting maneuvers to relieve inanition and are done in cases of cachexia, metastases, and advanced age. The contraindications to the procedure are the presence of a bronchial esophageal fistula, and signs of periesophagitis.

The deaths occurring in this palliative surgery were due to pulmonary thromboses, bronchopneumonia, esophageal fistulas, syncope, and shock (3 cases).

In summarizing their results, the authors indicate that they believe there is a postoperative intestinal motor disturbance which leads to troublesome diarrhea in these patients after total excisions; they have not observed this following palliative anastomoses. They mention postoperative gastrectomy anemia briefly. Four recurrences have been encountered in the authors' series at 2, 5, 6, and 10 months. Following palliative resection and anastomosis 2 patients had a recurrence with obliteration of the palliative anastomosis.

The authors conclude by saying that esophageal cancers are definitely within the surgeon's province; that each case has to be judged individually, and that the type of anastomosis cannot be definitely determined preoperatively.

JANE C. MACMILLAN, M.D.

Cervical Esophagogastric Anastomosis Following Subtotal Resection of the Esophagus for Carcinoma. ROBERT H. WYLIE and EDGAR L. FRAZELL. *Ann. Surg.*, 1949, 130: 1.

A case of carcinoma of the junction of the thoracic and cervical esophagus is presented with resection and esophagogastric anastomosis in the left cervical region. The patient is alive and well 14 months after operation which shows the value of this procedure for palliation, if not for cure.

JOHN J. MALONEY, M.D.

Cervical Esophagogastrostomy Following Resection of Supra-Aortic Carcinoma of the Esophagus. RUDOLPH NISSEN. *Ann. Surg.*, 1949, 130: 21.

A case of cervical esophagogastrostomy following resection of a supra-aortic carcinoma of the esophagus is reported. The satisfactory outcome of the operation indicates the justification of a combined cervicothoracic approach as recommended by Garlock. The role of the vagi in postoperative disturbances is discussed. The article is well illustrated.

JOHN J. MALONEY, M.D.

Further Report on the Operation of Esophagogastrostomy. HERMAN TAYLOR. *Brit. J. Surg.*, 1949, 36: 419.

A new operation for upper midzone growths of the esophagus, whereby alimentary continuity is restored by presternal subcutaneous esophagogastrostomy was described in 1945. Further experience since that time has shown the necessity for subdividing the operation into two major stages and one minor stage (to avoid infections).

The technique of this modification is described, and the favorable status of a patient operated upon 2½ years previously, with removal of a large squamous carcinoma from a level 5 cm. below the cricoid cartilage, is reported.

FRANK B. QUEEN, M.D.

Mediastinal Tumors of Blood Vascular Origin. WILLIAM D. SEYBOLD, JOHN R. MCDONALD, O. THERON CLAGETT, and STUART W. HARRINGTON. *J. Thorac. Surg.*, 1949, 18: 503.

The present report deals with 3 cases of mediastinal tumor in which the histologic picture was that of hemangioma or malignant hemangioendothelioma; these 3 tumors were encountered among approximately 200 mediastinal tumors treated surgically at the Mayo Clinic prior to January 1, 1947. A careful, though necessarily incomplete, perusal of the literature on mediastinal tumors brought to light reports of 14 additional cases of blood vascular origin.

The criteria for inclusion in this series were (1) location of the tumor in the mediastinum, (2) absence

of a tumor in the lungs, (3) pathologic verification by postmortem examination or by surgical exploration, and (4) the histologic picture of blood vascular spaces lined with endotheliomatous tumor cells. A conscientious effort has been made to avoid the error of including in this group highly vascular malignant tumors that were not of vascular origin.

Primary mediastinal tumors are uncommon; those of blood vascular origin are rare. The most frequent lesions among them are benign tumors of nerve origin and cystic lesions of teratomatous or enterogenous origin. Many other varieties of mediastinal tumors have been reported.

In 2 of the authors' 3 cases, the tumors showed evidence of malignancy. One patient had a lesion that had invaded surrounding mediastinal structures and was too extensive for surgical removal; the other had a lesion which was histologically of low grade malignancy and which had invaded a contiguous sympathetic ganglion. The third patient had a benign hemangioma.

Among 14 cases gleaned from the literature, there was evidence of malignancy in 8, and in 6 of these the lesions were histologically malignant; in 2 cases the lesions were called histologically "benign" but there were regional and distant metastases.

Of the entire group of 17 patients, surgical removal of the lesion was accomplished in 6; 4 of these 6 were living at the time of the last available reports. This cannot be interpreted in terms of operability, for some of these patients came under observation long before lesions in the mediastinum were surgically accessible.

There is evidence to support the contention that so called benign hemangiomas associated with metastatic tumors are in reality multiple primary lesions. The outlook for a patient with a single, well encapsulated, histologically benign hemangioma of the mediastinum is probably excellent. Even when it is not well encapsulated and cannot be completely removed, the outcome is hopeful on the basis of the report of Adams and Bloch whose patient was alive and well 4 years after operation. The prognosis must be guarded in those patients who have a lesion with histologic features of malignancy, and the prognosis in the individual case cannot be predicted, as it almost never can be in neoplasms in any situation, on the basis of histologic appearance alone. Lilienthal's case rather dramatically illustrates the truth of this statement.

No mediastinal tumor produces a sufficiently distinctive clinical or roentgenologic picture to permit a consistently accurate pathologic diagnosis. Many of these tumors are cancerous, others have cancerous potentialities, and all should be removed surgically unless a definite contraindication exists.

MISCELLANEOUS

Spasm and Retraction of the Cardiophrenic Junction (Spasme et rétrécissement cardiophrénique). LOUISE DE VAUX. *Bruxelles méd.*, 1949, 29: 1121.

The author discusses nonmalignant lesions of the lower third of the esophagus, particularly those associated with spasm at the cardioesophageal junction. Special emphasis is placed not only on the fact that the esophagus has both parasympathetic as well as sympathetic innervation but also on the fact that the vagus nerve carries both stimulating and inhibiting fibers. An attempt is made to explain spasm at the cardioesophageal junction by the fact that peristaltic action of the esophagus is controlled by reflexes both of bulbar and of local origin. It is conceivable that even though the peristaltic action as governed by reflexes originating in the higher centers is normal and orderly, there may be esophageal muscular spasm resulting from reflexes arising locally in the lower third of the esophagus. Inflammation, particularly in and about the cardioesophageal junction, plays an important role in the production and maintenance of such reflexes.

In addition to local reflexes, spasm of the diaphragm is believed to account for much of the benign obstruction of the esophagus resulting in the megaesophagus usually seen in such conditions. However, the megaesophagus is not necessarily the result of spasm for there may be spasm without dilatation as well as dilatation without spasm.

The concept of local reflexes arising in the lower third of the esophagus is well known and needs only to be emphasized to give it due credit in explaining spasm at the cardioesophageal junction. The author by no means restricts the causation of spasm to this one cause, but rather presents it as the most common etiological agent. The dissociation of vagus and sympathetic flow to the esophagus brought about by the opposing bulbar and local reflexes and which results in spasm of the affected segment is termed vagosympathetic dissociation by the author.

ORVILLE F. GRIMES, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

The Treatment of Acute Peritonitis with Aureomycin. Louis T. Wright, William J. Metzger, Edward B. Shapero, Sylvester J. Carter, and Others. *Am. J. Surg.*, 1949, 78: 15.

This is a preliminary report on the use of aureomycin in the treatment of 52 unselected patients with acute peritonitis due to appendicitis, perforated gastroduodenal ulcers, and perforated diverticulum.

There has been a definite reduction of the mortality in this small series when compared with the hospital mortality for the previous 2 years. All deaths occurred prior to the introduction of the intravenous-oral therapeutic regimen.

The bacteriologic findings were inconclusive when correlated with the clinical course. A mixed flora was the common finding in appendical peritonitis, while a pure culture was the usual finding in perforated ulcers.

The combination of initial intravenous dosage followed, as soon as feasible, by oral administration of the drug has proved clinically to be the most successful procedure. Five hundred milligrams of the drug, with 500 c.c. of 5 per cent glucose in water as the vehicle, were given by infusion twice daily. As soon as the Wangensteen suction could be safely interrupted, oral dosage of 500 mgm. twice daily was begun and usually continued for an average of from 7 to 10 days.

Minimal toxic reactions were noted. The drug produced a chemical phlebitis in some patients but did not prolong the course of the disease.

Aureomycin has proved to be of significant value in the therapy of peritonitis. However, the author's series is too small to define the precise role of the antibiotic in this grave infection, but the results were impressive enough to warrant further extensive clinical investigation of the drug.

John J. Maloney, M.D.

Further Experiences with Streptomycin Therapy in Peritonitis. Edwin J. Pulaski, Arthur B. Voorhees, Jr., and Sam F. Seeley. *Ann. Surg.*, 1949, 130: 242.

The present study of streptomycin in the treatment of fecal peritonitis is a continuation of a preliminary report published in December, 1947. The 85 cases upon which it is based include 54 of the cases analyzed in the earlier report. All data, as in the first report, are derived from case histories submitted to the office of the Surgeon General as part of a special study of streptomycin in various Army installations.

Statistical conclusions are not possible from the analysis of the 85 cases of fecal peritonitis presented in this communication and treated with streptomycin alone or in combination with other drugs. Clear-cut trends, however, permit the following impressions: in early spreading peritonitis in which the infecting organism originates in the gastrointestinal tract, combined treatment with streptomycin and penicillin seems to offer no significant advantage over streptomycin alone. In the management of localizing lesions, on the other hand, combined therapy seems superior. On empirical grounds, the optimal dosage of streptomycin, whether the drug is used alone or in combination, seems to be at least 2.5 gm. daily. After 48 hours it is usually possible to predict, with fair accuracy, the success or failure of streptomycin therapy. The optimum course of therapy is from 7 to 10 days. Administration of streptomycin should be continued for at least 48 to 72 hours after the temperature returns to normal, to prevent the development of an escape phenomenon. An analysis of the response to antibiotic therapy in peritonitis is attended with difficulties. If such an investigation is undertaken, minimum information necessary for an adequate analysis consists of accurate temperature and pulse curves, notations as to the blood and electrolytes administered, periodic estimates of the nutrition, and accurate notations of the return of borborygmi. Data are also necessary as to the condition of the skin wound and the results of rectal examination for possible abscess formation.

Benjamin Goldman, M.D.

GASTROINTESTINAL TRACT

The Management of Patients with Bleeding from the Upper Gastrointestinal Tract, with Buffer and Thrombin Solution. Byrne M. Daly, Charles G. Johnston, and Grover C. Penberthy. *Ann. Surg.*, 1949, 129: 832.

Studies were made on 100 consecutive cases of upper gastrointestinal bleeding. The results in these cases would lead one to believe that the use of thrombin and buffer is useful in controlling hemorrhage from the upper gastrointestinal tract. In cases in which this method fails, early operative intervention is recommended.

The procedure is important as an aid in the differentiation of those cases in which hemorrhage can be controlled and, on the other hand, those in which surgical intervention is required to stop hemorrhage. The buffer is used to neutralize the acid content. A Levine tube is passed into the patient's stomach and the stomach is then washed out with buffer or saline solution. Buffer solution consists of 20.4 gm. of disodium phosphate in a liter of water and 1.95 gm. of dihydrogen potassium phosphate in 100 c.c. of water. These substances are mixed, to produce 1,100 c.c. of seventh-molar phosphate buffer with a *p*H of 7.6. This is allowed to remain for a period of 5 minutes. An additional 50 c.c. of phosphate buffer is then introduced along with 10,000 units of topical

thrombin. The tube is clamped for 30 minutes and then, by means of slow gentle suction, the material is removed and observed. If the bleeding has stopped, the material removed is finely granular and light-colored. If the bleeding continues, fresh blood-stained material can be seen in the tube. If there is no further evidence of bleeding, 50 c.c. of buffer solution is introduced every 30 minutes and allowed to remain for ½ hour, when it is aspirated. In cases in which the bleeding continues and it appears to be uncontrolled by the administration of thrombin, other methods for controlling hemorrhage are carried out.

The causes and results of bleeding, the number of treatments needed for control, and the age incidence are presented. RICHARD J. BENNETT, JR., M.D.

Vagotomy and the Anatomic Variations in the Vagus Nerve. ALDEN K. BOYD. *Am. J. Surg.*, 1949, 78:4.

In dissections of 50 adult, thoroughly fixed cadavers, the vagus nerves passed from the posterior aspects of the lung roots to the sides of the esophagus in two to five trunks on each side.

These trunks descended obliquely, branching and anastomosing, the left trunks passing to the anterior and left lateral aspect of the esophagus, and the right trunks to the posterior and right posterolateral aspect of the esophagus.

There were several branches passing from the right or posterior complex downward anteriorly to join the anterior complex, and one or more branches passing posteriorly to the esophagus and downward from the anterior complex to join the posterior complex, these branches serving to render the lateral limits of the two complexes indefinite.

Passing through the esophageal hiatus, in 7 specimens there were single anterior and posterior gastric nerves; in 4 specimens there were one anterior and two posterior nerves; in 13 specimens there were one posterior and two anterior nerves; in 7 specimens, two anterior and two posterior nerves; in 10 specimens, three or more anterior nerves and one posterior nerve; and in 9 specimens, three or more anterior and two or more posterior nerves.

Subdiaphragmatically, the anterior nerve(s) split close to the hiatus into left and right terminal branches. The left branches split off to the left and were distributed to the anterior gastric wall, the fibers running perpendicularly to the axis of the stomach as do the branches of the principal nerve of the lesser curvature. The right branches consisted of one or more branches running through the lesser omentum to the liver, the principal nerve of the lesser curvature and one or more running along the lesser curvature to the incisura with branches to the left gastric artery.

Subdiaphragmatically, the largest branch of the posterior nerve(s) terminated in the celiac ganglion, other branches following the lesser curvature, and all branches being distributed to the posterior aspect of the stomach perpendicularly to its axis, the branches arising from 1 to 2 cm. below the hiatus caudad.

In 76 per cent of dissections, nerve trunks passed caudad for variable distances between fibers of the longitudinal muscle layers of the esophagus, and in 22 per cent of specimens one or more trunks passed through the esophageal hiatus in this fashion.

In all instances in which more than one trunk passed through the hiatus anteriorly, dissection along the largest anterior trunk 5 cm. above the hiatus and 2.5 cm. below revealed communicating rami to the less obvious trunks also passing through the hiatus anteriorly. More than one trunk passed through the hiatus anteriorly in 78 per cent of cases.

Throughout the dissections the posterior gastric nerve(s) showed less variation than the anterior nerve(s) at the hiatus, being located in 96 per cent of specimens between the posterior midline of the esophagus and the right border; and if present as two trunks, these usually were no more than 0.4 cm. apart at the level of the hiatus.

Anterior gastric nerve trunks could not be so dependably localized, being somewhere on the anterior aspect of the esophagus at the hiatus, although the largest trunk in 80 per cent of specimens was situated somewhere between the anterior midline and left border of the esophagus.

Complete vagotomy can be accomplished only by stripping the esophagus (and upper stomach in subdiaphragmatic approaches) of all obvious nerve trunks and adventitious tissue down to the outer longitudinal muscle layer over a distance of not less than 8 cm.

It is believed that vagotomy is technically feasible through the abdomen. This approach offers the advantages of simultaneous exploration of the abdominal viscera, examination of the ulcer-bearing area, and easy performance of drainage, or revisions of previous operations. JOHN J. MALONEY, M.D.

Bleeding Peptic Ulcer. EDWARD F. LEWISON. *Arch. Surg.*, 1949, 59: 37.

This article is a comparative study of 218 cases of gross gastrointestinal bleeding caused by peptic ulcer and treated at Johns Hopkins Hospital. These cases constitute 9 per cent of the patients hospitalized for treatment of peptic ulcer.

As in other similar studies, the mortality rate of severe hemorrhage in patients under 50 years of age is only 5.3 per cent, as contrasted with 11.8 per cent in patients over 50 years of age. The author does not say whether or not this fact influences the decision to submit patients to surgery rather than treat them medically. However, he does point out that young patients with elastic arteries may die of hemorrhage. In this series, hemorrhage was divided into minimal, moderate, and massive types. As expected, the mortality is highest in the latter group.

Azotemia as indicated by an elevated blood urea nitrogen is present in massive gastrointestinal hemorrhage and this test may help sift the simple from the severe cases. Some observers report that the rise in blood urea closely parallels the degree of hemorrhage into the gastrointestinal tract and is present within a day or two after the hemorrhage occurs.

British surgeons have stressed the importance of severe or intractable pain as a precursor of ill-boding in cases of hemorrhage from ulcer. This fact was not confirmed by these cases.

A history of ulcer was present in 75 per cent of the cases. The fatality rate with hemorrhage was just as high in first hemorrhages as in subsequent ones.

The diagnosis seemed relatively easy to arrive at in most cases and confirms other reports by American writers as contrasted with other countries. This is probably due to a prevalence of other lesions such as gastritis in other countries.

Arteriosclerosis and hemorrhage producing severe, as contrasted with slight, anemia increased the mortality rates in this series.

For numerous reasons it is hard to appraise the treatment of bleeding ulcers. Medical treatment consists of complete physical and mental rest, the frequent feeding of a soft nutritious diet, the administration of antacids, the intravenous use of dextrose, isotonic sodium chloride solution and amino acids, plasma and blood transfusions, sedatives, antispasmodics and narcotics, and all other ancillary measures indicated. Morphine was the most common narcotic used. Prompt, frequent feeding in the manner of Meulengracht was most commonly used and among the 76 patients thus treated there were no deaths. Among 11 patients with hemorrhage from ulcer who were placed on a prolonged and strict program of starvation there were 6 deaths, or a mortality rate of 54 per cent. Aluminum hydroxide was the antacid of choice for use in conjunction with the diet.

The value of transfusion was hard to evaluate statistically, but the author thought that examination of individual records made the value of blood and plasma obvious.

Approximately from 5 to 10 per cent of the patients treated medically die and the medical mortality in this series was 8.8 per cent. The clinical problem of the surgical care of hemorrhage resolves itself into the differentiation of cases which cannot be controlled without surgical treatment, the selection of the optimum time for operation, and the determination of the best type of operative procedure. The best factor to determine the need of surgery is the failure to control hemorrhage medically, but this usually means the loss of the optimum time for surgery, the so-called golden 48 hours of Finsterer.

These patients, for the most part, were treated medically during the phase of active bleeding. Partial gastric resection was the procedure of choice in 56 of the 82 who received surgical treatment. Early operation was infrequently performed. The total mortality for the patients treated surgically was 4.9 per cent. Recurrent hemorrhage after surgery occurred in the few cases followed up, as often as not after ventriculus operations.

Seven patients were subjected to vagotomy in addition to some other operative procedure, and during a 6 months' careful follow-up none had had recurrent hemorrhage. This agrees with a personal communication from Dragstedt in which he stated 34 of 35 patients with severe hemorrhage were treated by vagotomy alone with no deaths or recurrences.

FREDERICK C. HOEBEL, M.D.

Intussusception in Infants and Children. WILLIAM H. SNYDER, JR., ALFRED R. KRAUS, and LAWRENCE CHAFFIN. *Ann. Surg.*, 1949, 130: 200.

In the 143 cases reported, intussusception occurred most frequently among well nourished, apparently well infants between the ages of 4 and 9 months. Sixty-three per cent of the infants were males, and 37 per cent were females. The onset of symptoms was usually abrupt, with intermittent attacks of severe abdominal pain lasting for a few minutes, and followed by a free interval of from 15 to 20 minutes, in which the child appeared perfectly well. The attacks of pain were often followed by nausea and vomiting, and, in 55 per cent of cases, by bloody stools. A mass was felt in 69 per cent of the cases. Roentgenograms and barium enemas are sometimes helpful in establishing the diagnosis, the barium enema at times being even curative.

Intussusception must be differentially diagnosed from intestinal colic unaccompanied by mechanical obstruction, Henoch's purpura, gastritis, enterocolitis, and allergic states.

Among the 143 children who were treated during the last 10 years, the overall mortality was 4.8 per cent. In 125 consecutive cases in which operations were performed, with reduction or resection, the mortality rate was 4 per cent. These good results are believed to be due to early diagnosis, early surgical intervention, proper preparation, and after care with suction, fluid, electrolytes, blood, and antibiotics. At operation, 1 gm. of streptomycin in 3 c.c. of saline is injected into the bowel proximal to the intussusception if diarrhea was present before the onset of symptoms of the intussusception, and if a severely damaged intussusceptum is found. This supplements the parenteral administration of antibiotics.

SAMUEL KAHN, M.D.

The Clinical Importance of Duodenal Diverticula. EDGAR M. DUNSTAN, MASON I. LOWANCE, and EUGENIA C. JONES. *South M. J.*, 1949, 42: 460.

The authors present a case study of 4 patients with duodenal diverticula. In one instance a leiomyosarcoma of a diverticulum, and in another a leiomyoma was found. In neither of these cases was it possible to visualize the pathologic process by barium study.

In a review of the literature on duodenal diverticula, 32 cases were discovered, in 4 of which treatment by surgical excision was successful. Opinions vary regarding the pathogenesis and care of duodenal diverticula, and the negligible digestive symptoms make diagnosis most difficult. The poor response to medical treatment, however, justifies a surgical approach and, in some instances, makes it a lifesaving procedure.

STEPHEN A. ZIEMAN, M.D.

Submucous Lipomas of the Colon. ROBERT R. BIGELOW and ALEXANDER J. ANLYAN. *Arch. Surg.*, 1949, 59: 114.

This article adds 7 new cases of submucous lipoma of the colon to the literature and reviews the characteristics of this relatively rare tumor. The 7 cases presented fit the previous descriptions in the literature quite accurately.

Submucous lipomas of the gastrointestinal tract are usually single but several cases of multiple lipomas have been reported. These tumors are made up of highly vascular, lobulated masses of adult fat cells covered by flattened atrophic mucosa, and vary in size from 1 to 12 cm. They usually are on a long pedicle. Hemorrhage, ulceration, cystic degeneration, inflammation, and necrosis may occur. In order of frequency the following points of the colon are affected by these tumors: cecum, ascending colon, sigmoid, transverse colon, rectum, and descending colon. In this series of cases the ages of the patients varied from 40 to 60 years and there were more women than men.

The signs and symptoms of submucous lipomas of the colon are not pathognomonic. They are colicky abdominal pain, a palpable tumor, constipation, loose stools, loss of weight, rectal bleeding, and anemia.

The authors report 2 syndromes: (1) a chronic course lasting years, and (2) an acute onset of symptoms usually related to the three possible complications of these tumors—obstruction, intussusception, and hemorrhage.

X-rays may lead to the diagnosis of a benign tumor. If the lipoma is of sufficient size it may appear in the mucosal relief roentgenograms as a radiolucent area.

At operation, particularly if fluoroscopy suggests the possibility of such a lesion, diagnosis may be aided by the yellow color of the tumor, its pedunculated nature, the dimpling of the serosa at the base of its pedicle, its elasticity on palpation, the absence of infiltration at its base, and the absence of local or distant metastasis.

If the diagnosis is made, local resection by enucleation or by cutting the pedicle is the operation of choice. In a few cases, local resection of the bowel with end-to-end anastomosis may be necessary.

FREDERICK C. HOEBEL, M.D.

Intussusception of the Appendix. MARTIN E. CONWAY. *Illinois M. J.*, 1949, 95: 370.

A young physician practicing in a farming community, far from the great centers of research, who is willing to make the effort to share with his colleagues any unusual experiences in surgery, is especially to be commended. The author here adds his report of an appendical intussusception to the reports of this condition already published (about 100).

The patient was a 5 year old boy who had been suffering for 2 months from abdominal distress, nausea, and loss of appetite. Twelve hours prior to examination there was increased distress accompanied by loose stools. Examination revealed a poorly nourished child with rounded abdomen, tenderness at McBurney's point, right rectus rigidity, and, on rectal examination, a questionably palpable mass in the right lower quadrant. There was a white blood count of 28,000, 70 per cent polymorphonuclears, and a 1-hour sedimentation rate of 14 mm.

A tap water enema and 300,000 units of penicillin in wax seemed to bring some relief; in fact, the next day the abdominal distress, muscle rigidity, and tenderness to pressure had disappeared. Nevertheless the white count was 36,000, with a differential count the same as that of the previous day, and rectal examination disclosed a definite mass in the appendical region.

Laparotomy disclosed straw-colored fluid in the peritoneal cavity. The omentum was draped protectingly over the cecum and terminal ileum. The appendix was found to be inverted into the cavity of the cecum with the exception of about 1 cm. of the tip. The intussuscepted portion was "milked out" and the appendix itself removed. Recovery was uneventful.

The removed organ, after fixation, measured 5.8 by 0.7 cm. and was otherwise essentially normal except for some fibrous tissue obliteration of the lining and some secondary thinning out in the area involved in the intussusception.

JOHN W. BRENNAN, M.D.

Tuberculosis of the Appendix (Tuberculose do apéndice). J. CONDE. *Clin. contemp.*, 1949, 25: 1384.

The author describes 9 cases of tuberculosis of the appendix found among 2,625 patients operated upon for appendicitis, an incidence of 0.4 per cent. Localization of the tubercle bacillus is favored by various factors such as: form, disposition, and structure of the appendix; old inflammatory processes; gastrointestinal disease; congenital anomalies; presence of foreign bodies; richness in lymphoid tissue; ease of catarrhal inflammation; deficient drainage of the appendicular lumen; and richness in bacterial flora. The tuberculous lesion of the appendix may be primary in rare cases, but is usually secondary to a focus in some other part of the body, mostly the lungs. Various types of lesion have been described under different designations, but the most frequent form is the ulcerative lesion which is mentioned in all classifications.

Macroscopically, in this form the organ is of normal aspect, except for some slight signs of inflammation. Transverse section shows greater thickness of the layers and principally more marked separation between them. The mucosa presents multiple or solitary ulcerations with round or irregular contours, located in the distal third or at the base of the organ; the solitary ulcer has detached edges and an irregular bottom. Histologically, the lesions are located in the mucosa and submucosa and present the aspect of the tubercle. There are various lesions of vegetating endarteritis, venous thrombosis, and tuberculous

lymphangitis. These lesions may invade all layers up to the peritoneum and even destroy the serosa with resulting peritonitis. The lesions may be limited to the presence of multiple tubercles without destruction and be located in one or more of the layers of the appendix, including the subserosa. The organ may be retracted and reduced to a small stump, constituting a real tuberculous cavern, sometimes communicating with the cecum or ileum.

In the hyperplastic form, the organ is increased in volume and may reach a diameter of 3 cm. Section reveals disappearance of the various layers, a grayish color, and sometimes a cavern; the mucosa is intact.

The clinical picture of tuberculous appendix is far from being characteristic, and the diagnosis is rarely made before operation, and especially not before histologic examination. There may be a syndrome of acute or of chronic appendicitis, or no symptoms at all. When the syndrome of chronic appendicitis is associated with diarrhea, weight loss, asthenia, afternoon fever, and the presence of a tumor in the right iliac fossa, the diagnosis is suggested, especially if there is also an active tuberculous lesion. Some of the author's patients presented an acute syndrome with diarrhea and fever; others had a chronic evolution without characteristic symptoms; no patient had ascites or exaggerated tympanism.

Treatment is appendectomy, and extirpation must be complete because postoperative fistula occurs more frequently when the base of the organ has not been removed. Drainage should be omitted as it seems to favor fistula formation. The operative mortality is not increased by the presence of pulmonary tuberculosis; on the contrary, the latter sometimes evolutes more favorably after extirpation of the appendix. RICHARD KEMEL, M.D.

Conservative Surgery in Cancer of the Rectum (Cirujia conservadora en cancer de recto). ARNALDO YÓDICE, ALBERTO GARCIA MATA, and R. ALBERTO CIARLO. *Rev. As. méd. argent.*, 1949, 653–654: 213.

Very good surgical results were obtained from conservative treatment of cancer of the rectum with preservation of the anal sphincter. The Babcock technique with extensive extirpation of the superior and lateral lymphatic chains was followed by only 1 immediate postoperative death. Good function of the sphincter was observed in 9 of the 12 cases which were followed up. WILLIAM E. RICKETTS, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Biliary Hepatitis. KARL A. MEYER, HANS POPPER, and FREDERICK STEIGMANN. *Q. Bull. Northwest. Univ. M. School*, 1949, 23: 321.

Morphologic liver cell damage was seen in the vast majority of cases of extrahepatic biliary obstruction in which biopsy specimens of the liver were available. Only in a minority of these cases of biliary hepatitis was there found morphologic evidence of a complicating infection of the portal triads (purulent hepatitis).

The "pure" biliary hepatitis is associated with reduced serum albumin levels and with great abnormalities in the tests which indicate marked interference with bile flow. The cephalin flocculation and zinc sulfate turbidity are normal, while the thymol turbidity is normal or only slightly elevated.

In the purulent hepatitis, functional liver damage is more marked than in the "pure" biliary form. In addition, thymol turbidity and cephalin flocculation become markedly abnormal, while the zinc sulfate turbidity may remain normal. Although the theoretical explanation of this discrepancy between morphologic liver cell damage and the results of the flocculation tests in biliary hepatitis is not fully explained, this behavior is of great value in the differential diagnosis between medical and surgical jaundice. The zinc sulfate turbidity is negative in nearly every type of surgical jaundice, whereas cephalin flocculation and thymol turbidity are markedly abnormal only in the infected variety, which can be recognized by clinical manifestations.

Hepatic function tests and liver biopsy are only of limited value in differentiation of the various causes of extrahepatic biliary obstruction, and especially in distinguishing the benign from the malignant form. In general, liver cell damage is more severe and purulent hepatitis more common, and the evidence of marked bile flow interference less definite in the benign than in the malignant form. This is especially noted in inflammatory conditions, such as strictures or suppuration of the gall bladder in the benign form. SAMUEL KAHN, M.D.

A Consideration of the Banti Syndrome. PHILIP F. WAGLEY. *Bull. Johns Hopkins Hosp.*, 1949, 85: 87.

The Banti syndrome is characterized by anemia, leucopenia, occasionally thrombocytopenia, splenomegaly, and evidence of hepatic disease or altered portal circulation. It is associated with a variety of diseases. Although splenic vein hypertension has been seen frequently in this condition and may be due to several different changes in the portal and splenic vascular system, the role which such hypertension plays (other than leading to the formation of gastrointestinal varices and subsequent blood loss) is unexplained. However, evidence for and against two suggested roles of the spleen in this syndrome is quoted: increased damage to the red blood cells within the enlarged spleen, and a humoral effect on the bone marrow by the spleen. The most effective therapy, particularly in the early stages and in younger patients, is apparently splenectomy, dietary treatment for cirrhosis, and supplementary iron, orally. CHARLES BARON, M.D.

Experimental Injury of the Common Bile Duct. JOHN R. HILSABECK and FREDERICK C. HILL. *Arch. Surg.*, 1949, 59: 240.

The present article is concerned with lesions of the common duct produced by direct trauma. Traumatic lesions of the common duct may be produced in various ways: (1) the duct may be accidentally

crushed during an operation, (2) a ligature may be applied to the duct, (3) the duct may be partially or completely cut, (4) a portion of the duct may be accidentally excised, (5) the duct may be cut longitudinally, (6) the mucous membrane of the duct may be injured by too vigorous probing and scooping, and (7) a stone, by long residence in the common duct, may produce injury of the wall of the duct, and it is possible that the passage of a large stone may be followed by mucosal damage.

Since injuries of the duct produced in known ways are not often encountered in man at an optimum time to determine the exact effect of the lesions, the experimental approach has a definite advantage.

A surgical gut ligature on the common bile duct of dogs was absorbed, and the jaundice cleared. A nonabsorbable ligature can be removed, with relief of the obstruction. Stricture did not follow during the period of observation. Crushing of the common bile duct may be followed by dilatation of the duct, but jaundice did not develop. Complete section of the common duct was not followed by spontaneous healing of the duct. Partial section of the duct, or partial anastomosis after complete section, is usually followed by healing of the duct. Choledochotomy and cauterization of the duct with phenol may or may not be followed by healing of the duct.

CHARLES BARON, M.D.

Acute Pancreatitis at Cook County Hospital. MANUEL E. LICHTENSTEIN and WILLIAM E. SULLENS. *Q. Bull. Northwest. Univ. M. School*, 1949, 23: 311.

Acute pancreatitis may occur in the absence of gall-bladder disease or may follow cholecystectomy. Usually, but not always, the disease seems to be due to passage of the pancreatic juice and bile through a common pathway, and endocholedochal sphincterotomy may suggest the line along which further progress may be made in the treatment of this condition.

Among the 50 patients diagnosed as having had acute pancreatitis, there were 17 deaths, a mortality of 34 per cent. The cases of pancreatitis have been divided into four groups: pancreatic edema, acute hemorrhagic pancreatitis, acute necrotic pancreatitis, and acute suppurative pancreatitis. In 30 of the 50 patients an incorrect diagnosis was made, and all but 1 of the 24 patients who were subjected to surgery had had a diagnosis of some condition other than acut pancreatitis. Among the patients operated upon there were 10 deaths, a mortality of 41.6 per cent, while in the group of 26 not immediately subjected to surgery there were 7 deaths, a mortality of 28 per cent. Stones in the biliary passages were found in only 6 of the 24 patients operated upon.

The essentials of medical management are: (1) papaverine for the relief of spasm and phenobarbital for sedation; (2) atropine and the avoidance of oral feedings to reduce pancreatic secretions; (3) Levine tube and suction; (4) adequate shock, fluid, and electrolyte therapy; and (5) extreme vigilance to rule out perforations of the bowel, intestinal obstruction, or other confusing diagnostic possibilities.

The authors conclude that emergency surgery has little to offer the patient who is ill with acute pancreatitis; that the amylase determination is an important diagnostic procedure, and that while exploration may be necessary to rule out other serious surgical emergencies, emergency surgery is not otherwise indicated in the acute phase of the disease.

F. J. LESEMANN, JR., M.D.

Total Pancreatectomy, with a Report of Postoperative Physiologic Studies. JACK GREENFIELD and JACK SANDERS. *Surgery*, 1949, 25: 824.

The authors present 1 case of carcinoma of the pancreas in which total pancreatoduodenectomy was performed. Following operation, physiological studies were carried out for a period of over 6 months. Simplicity of postoperative management is advised.

JOHN J. MALONEY, M.D.

Total Pancreatectomy for Hyperinsulinism Due to Islet-Cell Adenoma: Follow-up Report 5½ Years After Operation, Including Metabolic Studies. JAMES T. PRIESTLEY, MANDRED W. COMFORT, and RANDALL G. SPRAGUE. *Ann. Surg.*, 1949, 130: 211.

Apparently, the first case of a patient who survived the immediate postoperative period after total pancreatectomy was reported by Priestley, Comfort, and Radcliffe in 1944, sixteen months after operation. This patient constitutes the basis for the report, as she recently returned for a period of study, approximately 5½ years after removal of the pancreas. In the meantime, at the Mayo Clinic, 3 additional cases have been reported; and 1 additional total pancreatectomy has been performed for chronic pancreatitis with pancreatic lithiasis, but the case has not been reported.

During the 5½ years after pancreatectomy the patient remained in essentially good health. Her diabetes continued to be of relatively mild degree as compared to the type of diabetes which commonly occurs in children, adolescents, and young adults. In spite of the loss of large amounts of nitrogen and fat in the feces, she was able to maintain an excellent nutritional state. The values for blood lipids and serum proteins remained within the normal range and there was no abnormality of the functions of the liver, which were measured, in spite of the fact that the diet of this patient had not been supplemented with choline, lecithin, or any other lipotropic substance.

The Spleen and Splenectomy. RONALD BODLEY SCOTT. *Brit. M. J.*, 1949, 1: 1063.

Although the exact physiology of the spleen is not understood, it may be concluded that normally, there is an increase in the thickness of the erythrocytes passing through it, that it forms a cemetery for defunct red blood cells, and that it exerts some control over the maturation of erythroblasts. Splenectomy is followed by an increase in the peripheral leucocyte and platelet count. The explanation of neither phenomenon is certain.

The necessity for splenectomy in spontaneous or traumatic rupture is obvious. Occasionally, excision of cysts may be necessary.

The value of splenectomy in congenital hemolytic anemia in which the red blood cells are spherical and have an increased fragility is well known. In sickle-cell anemia splenectomy is without value. The Mediterranean type of anemia occupies an intermediate position between these two as regards the benefits of splenectomy. In acquired hemolytic anemias in which some external factor is responsible for the destruction of red blood cells and the cause is unknown, splenectomy must be recommended, as removal of the spleen will remove the organ responsible for destroying the red blood cells.

Idiopathic thrombocytopenic purpura has long been recognized as a condition in which splenectomy is often followed by a rise in the platelet count and by relief of the hemorrhagic symptoms.

The part played by the spleen is as yet undetermined, but the effect produced by its removal is certain.

The effects of the spleen on the leucocytes are less well appreciated than those on the red blood cells and platelets. There is a form of splenic neutropenia which occurs most commonly in women between the ages of 30 and 60 years, and is manifested by chronic ill health with recurrent skin and oral infections. The spleen is usually moderately, sometimes greatly, enlarged, and the blood count shows a persistent leucopenia with a white count of usually between 1,000 and 2,000 per cubic centimeter, with less than 20 per cent of neutrophiles. In many instances, splenectomy has been followed by restoration of a normal leucocyte count.

It is not surprising to find that in some instances the action of the spleen is exerted not on one variety of blood cell, but on all; the patients have anemia, neutropenia, and thrombocytopenia. This syndrome has been given the name of "splenic pancytopenia." In most of the reported cases of primary splenic pancytopenia, splenectomy has restored the blood to normal and the patient to health.

In Banti's syndrome, the splenomegaly is due to obstruction to the venous outflow, usually to thrombosis of the splenic vein. In these cases splenectomy is curative. However, if the portal hypertension is due to obstruction in the portal trunk or its branches, or if the portal hypertension is due to intrahepatic obstruction, splenectomy is without effect. In the presence of the last mentioned types of obstruction, the operations devised are to bypass the obstruction by shunting the venous flow via the splenic vein into the left renal vein, or by anastomosing the portal vein and the inferior vena cava.

ELY ELLIOTT LAZARUS, M.D.

GYNECOLOGY

UTERUS

A Case of Glioma of the Uterus. WILHELM BOSAEUS and HERBERT SWANBERG. *Acta obst. gyn. scand.*, 1949, 28: 39.

The authors review the literature on tumors of the uterus containing nervous tissue. They present a case of pure glioma of the uterus, the first ever described.

The patient was a married woman about 40 years of age, who was under treatment for pulmonary tuberculosis although she lived at home with her family and was fit for work. For the past few months she had noticed a few slight hemorrhages from the vagina between the regular menses. On pelvic examination the uterus was retroverted, of normal size, firm and nontender. The adnexa were normal. At the external os was a bean-sized, bleeding polyp.

Dilatation and curettage was performed with removal of the polyp. The specimen consisted of glial tissue and endometrium. These findings indicated removal of the uterus at a later date. The patient finally attained perfect health with a normal pelvis. A detailed pathological description of the glioma in the uterine wall is given. The glioma had a very benign appearance and was apparently a primary tumor. Although investigation has not contributed any definite information, some pathogenetic possibilities concerning the tumor are discussed.

T. FLOYD BELL, M.D.

Retroperitoneal Lymph Node Dissection in Cancer of the Cervix. JOE VINCENT MEIGS, LANGDON PARSONS, and IRA T. NATHANSON. *Am. J. Obst.*, 1949, 57: 1087.

Throughout the world for the past 15 years the accepted form of therapy for patients afflicted with cancer of the cervix has been the combined use of x-rays and radium. In recent years the results from this form of treatment have become known. While they are considerably better than those obtained from radium (which supplanted surgery), the rate of improvement has not been maintained. The fact remains that while survival statistics have improved they have apparently reached a plateau at a level which can hardly leave the therapist with a sense of complacency as to his accomplishments. Despite our best efforts to control the disease through early detection and more effective therapy too many patients die of the disease.

Approximately 60 per cent of the patients with cancer of the cervix die. Moreover, and here lies the challenge of this form of malignant disease, the majority die with the disease sharply confined to the pelvis. To be sure, certain patients, usually those with Grade 3 lesions, will die of remote metastases to the lungs and bone, but by far the greater number will come to a terminal issue with extensive disease in the pelvis alone.

Based on the assumption that x-ray treatment will not adequately care for the regional metastases in the iliac, hypogastric, and obturator areas, a surgical approach to this problem, which is still in an experimental stage, was suggested. Without detraction from the established form of treatment with x-rays and radium, a surgical attack on the distant nodes is added after there is a reasonable assurance that the local disease has been cured. To date no attempt had been made to alter the established plan of radiation therapy. The portals of entry continue to include the nodal areas, without consideration of the fact that these regions will be exposed surgically later.

The present experimental approach is extra-peritoneal. The operation has been performed in two stages at weekly intervals, although there is no major objection to doing a bilateral dissection at the same time, particularly in a young patient.

Fifty patients were subjected to this procedure. The morbidity has been low. Three instances of sepsis were noted, occurring in patients weighing 210, 225, and 245 pounds, respectively. The final result was satisfactory in all three. The mortality (4 per cent) has been disturbing. There have been 2 deaths from pulmonary embolus. The operation was staged at weekly intervals. In both instances the fatal embolus came without clinical warning 4 and 10 days, respectively, after the second stage. The primary source of the embolus was found in the opposite popliteal space in both instances. In one instance positive nodes were encountered; in the other, none. No other deaths were encountered. Much consideration has been given this problem. It has been the desire to keep this operation as simple as possible to remain effective.

The sole consideration in the selection of the suitable case for this operative procedure revolves around the evaluation of the chance of local cure 3 or more months after completion of the full course of radiation therapy. The estimate is based on clinical appraisal, vaginal smear, and biopsy. Mistakes have been made in the proper evaluation of the possibilities of local cure for there have been 7 cases, or 14 per cent, in which the disease has recurred locally following the dissection of the glands.

As to the value of this surgical adjunct in the treatment of cancer of the cervix, time alone will produce the answer. To date only 6 patients, of the whole group of 50, have died. The numbers are too small and the series too recent to offer further observations. A simple surgical procedure has been added to the armamentarium of treatment of cancer of the cervix as a supplement to the radiation therapy. While the immediate results are encouraging, the procedure of retroperitoneal node dissection following complete radiation therapy must be considered experimental.

JOHN R. WOLFF, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Some Clinical Aspects of Dysgerminoma Ovarii. HENRY JEDBERG. *Acta. obst. gyn. scand.*, 1949, 28: 194.

It has been reported that 3.7 per cent of ovarian tumors are dysgerminomas. These tumors occur most commonly in girls and young women, but the previous reported coincidence of hermaphrodism and pseudohermaphrodism has not been borne out. The dysgerminoma is homologous to the seminoma and many authors believe it is of teratoid origin. There is no characteristic symptomatology associated with this tumor; symptoms are often absent in the early stages, the sexual cycle is normal as a rule, and the most important finding is the discovery of an ovarian tumor which may have a very rapid growth. The tumor is solid, rounded, has a smooth outer surface as a rule, and is of a hard or rubbery consistency. It is usually very mobile because of its pedunculated growth. It may metastasize by direct invasion or by lymphatic spread.

The hormonal effect produced by the tumor has been in doubt; the author has made a hormonal analysis of one such tumor and examined the hormonal content of the urine in 2 such cases with negative results. He concluded that the tumor is hormonally unproductive. Fertility is not affected by the tumor.

The prognosis is doubtful. Unilateral cases are treated with unilateral oophorectomy and subsequent radiation with protection of the uninvolved ovary.

F. J. LESEMANN, JR., M.D.

A Case of Dysgerminoma Ovarii Tested Hormonally. ARTUR BER. *Acta. med. scand.*, 1949, 133: 411.

Since hormonal studies in women with dysgerminoma ovarii have been reported only rarely, the author presents the case of a 25 year old unmarried woman who had never menstruated and had never been pregnant. She had certain masculine features, such as muscular build, masculine face with a prominent nose, scanty growth of hair on the head, and a well developed Adam's apple. The breasts were flat and small, the mamillae small, flat, and erectible, with a feebly colored areola. Fat tissue was poor, especially in the labia majora, the buttocks and the breasts. Arms and legs were markedly haired. Hair 5 to 7 mm. long was present on the skin, and the patient had a visible, short mustache; on the upper lip there was a brownish pigmented line. Around the mamillae there were long separated hairs. Lordosis of the lumbar vertebrae was marked. There was distinct kyphosis of the thorax. The shoulder blades were prominent. The extremities were very long. The voice was metallic and low, but feminine rather than masculine. The abdomen presented a tumor slightly above the umbilicus.

Gynecological examination showed extreme development of the clitoris. The large and small labia were well developed. The vagina appeared to be normal.

The tumor weighed 1,700 gm. The opposite ovary was the size of a pin head, and the uterus was the size of a prune stone. Microscopically, the tumor was a dysgerminoma; it was well encapsulated and apparently benign. Hormonally (but not endocrinologically) it was inactive.

The urine was examined for sex hormones before and after operation. Before operation the urine showed a positive Aschheim-Zondek reaction, which became negative after operation. A large amount of estrogens appeared in the urine both before and after operation.

The author attempts to account for the presence of estrogens in the urine before and after the removal of the tumor, also to determine why the uterus and the vagina were undeveloped, the menstruation absent, and why the vaginal smears were similar to those found in the climacteric. In the first instance, the source of estrogens may have been the same before operation as after operation. Atrophy of the uterus and vagina can be explained most simply in that these organs had lost their reactivity to estrogens. Other possibilities of explanation are also considered.

These tumors develop as a result of hormonal imbalance beginning at an early age. This would be in accordance with the fact that dysgerminoma appear mostly in hermaphrodites or in women with hypoplastic genitals.

Notwithstanding the signs of masculinization, greater amounts of androgen may not be detected in the urine.

T. FLOYD BELL, M.D.

Primary Chorioepithelioma of the Ovary. GILBERTO MARRUBINI. *Acta obst. gyn. scand.*, 1949, 28: 251.

Primary chorioepithelioma of the ovary is very rare. The clinicopathological features of 18 authentic cases are summarized and 2 additional cases are reported in detail.

The hypotheses which may explain the secondary types of ovarian chorioepithelioma are summarized as follows:

1. Malignant degeneration of chorioepithelial elements carried to the ovary after a normal or tubal pregnancy.

2. Chorioepitheliomatous degeneration of the trophoblastic elements following an ovarian pregnancy.

3. Ovarian metastases of a primary uterine chorioepithelioma which healed spontaneously or was completely expelled or extirpated.

Because a long latency period may exist for chorioepithelioma to develop, the possibility of previous pregnancies, deliveries, or abortions must be excluded before the case can be considered to be primary.

From a critical study of the theories of histogenesis it would appear that the parthenogenetic or blastomeric theories for primary ovarian chorioepithelioma are not based on sufficiently convincing evidence. It is suggested that a primary chorioepithelioma of the ovary should be considered as a teratoid tumor.

The tumor is usually unilateral and most frequently involves the right ovary. The weight varies from a few hundred grams to some kilograms. Its shape is usually round or oval, and its surface is either smooth or largely nodular. Its consistency may be more or less firm, but more frequently it is spongy and friable because of the presence of extensive hemorrhagic and necrotic areas. The tumor is wine-red or bluish, with darker zones which at times may be blackish brown. Microscopically, its main structural elements are the syncytial and the Langhans cells which are pathognomonic.

Primary chorioepithelioma is usually a tumor of youth. In many cases the symptomatology is not unlike that of any other solid ovarian tumor. Before puberty there may be vaginal bleeding and acceleration of the development of the secondary sex characteristics. In the adult, amenorrhea or increased bleeding may be observed. Unfortunately, in most cases a biological test for pregnancy has not been performed. In several cases the Aschheim-Zondek test was strongly positive. The prognosis is usually hopeless; the only possible treatment is removal of the tumor as early as possible. Early metastases are always present. GEORGE BLINICK, M.D.

EXTERNAL GENITALIA

Primary Tuberculosis of the Vulva (Sulla tubercolosi primitiva della vulva). ICILIO PARDINI. *Riv. ital. gin.*, 1949, 3: 207.

Approximately 100 cases of tuberculosis of the vulva, 11 of them primary, have been reported in the literature, but in some of them the diagnosis was based exclusively on the clinical findings without being corroborated by laboratory studies. The author calls attention to the fact that the accidental presence of acid-fast bacilli may lead to the diagnosis of a tuberculous lesion while in reality a syphilitic condition is present. It follows that the incidence of tuberculosis of the vulva is very low.

The author reports a primary tuberculous lesion of the vulva in a 22 year old woman whose father was suffering from a specific condition of the lungs. The ulcer, of 5 years' duration, was located in the right labium minor, invading the vestibulum. The margins were elevated, the base, of a pinkish color, was secreting a serous fluid. The ulcer had a hard consistency and was only slightly painful on palpation. The corresponding labium major was edematous and there was a bilateral inguinal adenopathy. All other clinical findings, and the Frei and Kahn tests were negative. No spirochetes, tubercle bacilli, streptobacilli (ulcus molle), or gonococci could be detected in the smears of the secretion. Biopsy of the ulcer and a lymph gland disclosed the presence of Koch's bacilli and typical tuberculous lesions. The results of cystoscopic and urographic examinations were negative.

Surgical diathermy and x-ray therapy remained ineffective. The patient died a year after discharge from the hospital. JOSEPH K. NARAT, M.D.

MISCELLANEOUS

A Survey of 113 Cases of Primary Dysmenorrhea Treated by Neurectomy. O'DONEL BROWNE. *Am. J. Obst.*, 1949, 57: 1053.

Although the etiology of primary dysmenorrhea is unknown, Browne is of the opinion that modern living and our strict moral codes lead to permanent changes in the pelvic nerves. Neurectomy will usually relieve this condition.

Primary dysmenorrhea may be of the ovarian type, uterine type, or a combination of both. In the ovarian type the pain usually precedes the menstrual flow and the pain is referred to one or both lower quadrants. Palpation of one or both ovaries elicits a pain similar to that noted at menstruation. Division of the ovarian nerves is accomplished by dividing the infundibulopelvic ligament.

Uterine dysmenorrhea is characterized by pain during the menstrual flow and is reproduced by passing a sound into the uterine cavity. Presacral sympathectomy is the treatment for this type.

Combinations of the two types are frequent and in these both ovarian neurectomy and presacral sympathectomy should be performed.

Study of the removed nerve tissue showed degeneration and destruction of the sympathetic ganglion cells and postganglionic fibers, and replacement fibrosis in the nerves.

Eighty-two cases in which this surgical method was used are reviewed (24 ovarian denervations, 34 presacral sympathectomies, and 27 combinations). Eighty per cent yielded successful results, 10 per cent partial success, and 10 per cent failure. Yet among those in which the combined operation was done there was only 1 failure. The fertility was not impaired, and pregnancy and labor were normal in the married group. All patients recovered from the operative procedure without complications with the exception of 1 in whom the abdomen was reopened to resuture the infundibulopelvic ligament.

JOHN R. WOLFF, M.D.

A Study and Classification of Pelvic Inflammatory Disease. ROY W. MOHLER. *Am. J. Obst.*, 1949, 57: 1077.

Pelvic inflammatory disease is a dynamic process and the terms acute, chronic, subsiding, spreading, recurrent, and quiescent are all descriptive of some phase of the process which usually can be recognized clinically. The term chronic is not descriptive of the process which follows acute attacks of pelvic inflammatory disease and should be used only when it refers to reactions such as those caused by tuberculosis, foreign bodies, and other agents which induce slowly progressing processes.

The irritants which cause pelvic inflammatory disease are many, but they may be classified into two groups, namely, those of bacterial origin and those caused by some physical force or change in the status of the structures in the pelvis. The inflammatory processes of bacterial origin are thought to be caused

most often by the gonococcus, streptococcus, staphylococcus, colon bacillus, Welch bacillus, pneumococcus, tubercle bacillus, and the mycoses, which are recognized causes. There undoubtedly are others which have been unrecognized.

The physical changes in the pelvic viscera which may cause pelvic inflammation are almost unlimited. Some of the usual ones are ruptured graafian follicle, endometriosis, twisted ovarian cysts, twisted pedunculated pelvic tumors, degenerating myomas, tubal abortions and ruptured ectopic pregnancies, hemorrhage into pelvic tumors, torsions of the pelvic viscera (uterus, tubes, and ovaries with torsion of the uterus with the cervix as the axis), ruptured endometrial cysts, diverticulosis of the sigmoid, and many others. All of these conditions have been observed by the author, and it is the impression that the reaction induced by these changes is an inflammatory one, and that one is justified in classifying all of such changes as pelvic inflammatory disease with the cause stated as it can be determined. In many instances, the cause cannot be determined definitely and sometimes not at all because the patient has recovered spontaneously from the process, which has made further study unnecessary.

The three most common types of pelvic inflammation of infectious or bacterial origin are stated as the gonorrheal, the septic, and the tuberculous. These three types of inflammation have been recognized clinically for a long time. Pelvic inflammatory processes of infectious or bacterial origin generally can be considered to have characteristic methods of behavior, arise from a focus that communicates with or is contiguous to the internal genitalia, and seem to extend either on the surface or interstitially.

Pelvic inflammatory disease caused by physiological changes in the internal genitalia and preexisting tumors of these structures is a very definite entity, and, as the patient recovers spontaneously from the process, it is often assumed that a pelvic inflammatory disease of infectious origin has been present. Many of these processes are definitely inflammatory processes of noninfectious origin and are serious enough to warrant recognition and prompt surgical treatment. JOHN R. WOLFF, M.D.

Perforation of Pyosalpinx into the Urinary Bladder (Le piosalpingi perforate in vescica). GIORGIO DODERO. *Boll. Soc. piemont. chir.*, 1948, 18: 70.

Spontaneous perforation of a parametritic exudate or of an accumulation of pus in the adnexa into the rectum is approximately twice as frequent as perforation into the urinary bladder.

A 22 year old woman was admitted with complaints of fever, severe pain in the hypogastrium (chiefly on the right side), and dysuria. A vague abdominal pain had been present during the previous year.

An oval-shaped mass, the size of a hen's egg, with its greater diameter in the transverse direction, and of a hard, elastic consistency could be palpated in the right hypochondrium. A bullous edema was disclosed in the right superior quadrant of the bladder at cystoscopic examination. An increased flow of purulent liquid from an opening in the region of the edema could be produced by pressure on the afore-mentioned tumefaction.

Under spinal anesthesia the abdomen was opened through a low midline incision. A fluctuating cystic mass, contiguous with the uterus and adherent to the bladder, was exposed in the right iliac fossa. The ovary was adherent to the pyosalpinx. The mass was removed, the fistulous tract excised, and the opening in the bladder sutured. The patient made an uneventful recovery.

Especial attention and care should be observed during the operation to the ureter which may be adherent to the pyosalpinx.

JOSEPH K. NARAT, M.D.

The Origin of Placental Trophoblast and the Function of Placental Gonadotropin. ISRAEL GORDON. *Lancet*, Lond., 1949, 6559, 256: 807.

Though generally thought to be of fetal origin, trophoblast is formed when there is no embryo, lives on after the embryo has died, e.g., in hydatidiform mole, and is found when there never has been any possibility of a fertilized ovum as in chorioepithelioma in men, old women, and virgins. The trophoblast has extraordinary potentialities of invasion in the higher mammals even though often of different blood group. The trophoblast, though of fetal origin, mimics the maternal tissue, i.e., ovary and adrenals, by secreting estrogens, progesterone, and androgens.

These findings are hardly tenable with a fetal origin, and the author presents for discussion and experimentation the unorthodox view that the main portion of the placental trophoblast is formed from the follicle cells that surround the ovum when it leaves the ovary and are therefore maternal in origin. ELY ELLIOTT LAZARUS, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

The Developmental Mechanism of the Functional and Organic Disturbances of Pregnancy (Gestoses). HANNES SAURAMO. *Acta chir. scand.*, 1949, 29: Supp. I.

A classification of the toxemias of pregnancy is presented by the author. The mechanism of the development of these disorders is given in detail, with specific reference to the interaction of constitutional, nervous, endocrine, psychic, and physiological factors which may be responsible for these diseases.

GEORGE BLINICK, M.D.

Diagnosis and Management of Rupture of the Uterus. CHARLES A. GORDON, and ALEXANDER H. ROSENTHAL. *Am. J. Obst.*, 1949, 58: 117.

The clinical data of 64 deaths from rupture of the uterus are presented; 27 ruptures were spontaneous and 37 were the result of trauma. In all but 3 cases, rupture took place in the lower segment of the uterus. The role of cervical scarring in the etiology of rupture is emphasized.

Internal version is the most frequent cause and should be recognized as an extremely hazardous procedure under certain unfavorable conditions. Strong fundal pressure can rupture a uterus. Three ruptures of this type occurred in this series. Four deaths occurred from the use of pituitary extract during the first stage of labor. Despite this, the judicious use of minute doses in carefully selected cases of uterine inertia is advised.

The diagnosis of rupture of the uterus is often not made sufficiently early for survival of the patient. Routine exploration of the uterus after traumatic vaginal procedures is indicated, especially if shock is present. The essence of adequate treatment for complete rupture of the uterus is prompt massive blood transfusion and hysterectomy. Shock is no contraindication to operation.

JOHN R. WOLFF, M.D.

LABOR AND ITS COMPLICATIONS

Prolonged Labor. PAAVO VARA. *Acta obst. gyn. scand.*, 1949, 28: 490.

In a review of 12,031 full term occipitoanterior deliveries, the author found that the frequency of completed deliveries begins to fall decisively after 24 hours in multiparas, and after 30 hours in primiparas. Nevertheless, it is impossible to draw an exact time limit between normal and prolonged labor, the onset being defined as the time of the first painful contraction.

The chief causes of the prolongation of labor are uterine inertia and exhaustion. The percentage of patients with uterine inertia (as indicated by irregular intervals between pains) distinctly increases as labor is prolonged. The time interval between spontaneous rupture of the membranes and delivery is prolonged in those patients with longer labors. This is attributed to uterine exhaustion.

Premature rupture of the membranes remarkably shortens labor and does not impair the prognosis for mother or child. In premature rupture of the membranes, no great attention need be paid to the period of latency until labor begins, since the duration of labor and the frequency of infection are not influenced by this factor. However, if premature rupture is associated with uterine inertia and irregular pains at the onset of labor, more active therapy is required.

Labor is considerably more hastened by artificial rupture of the membranes, particularly when the cervix has dilated over 4 cm., than by spontaneous rupture of the membranes. The timely artificial rupture of membranes for hastening labor is useful in the treatment of latent uterine exhaustion.

In older primiparas the incidence of forceps operation distinctly rises after 30 hours of labor. In multiparas this increased incidence is particularly conspicuous after 24 hours. However, such procedures do not seriously influence adversely the prognosis of either the mother or child.

The most important criterion in the evaluation of the duration of labor is the interval between the rupture of the membranes (spontaneous or artificial) and the delivery, particularly if labor has already begun.

GEORGE BLINICK, M.D.

The Difficulties with Cervical Dilatation and with Spasmodic Conditions in Deliveries Complicated by Prolapses and by Cervical Hypertrophy (Troubles de la dilatation du col et spasmes dans l'accouchement compliqués de prolapsus avec hypertrophie du col). R. KELLER. *Rev. fr. gyn. obst.*, 1949, 44: 73.

Edematous hypertrophy followed by cicatricial induration, at times complicated by extensive ulceration, is the sequela to be expected in long continued prolapse of the uterus. In spite of the severity of many of these lesions the child will, as a rule, be delivered spontaneously, perhaps with the help of one or more incisions into the resistant ring of cirrhotic tissues constituting the external cervical orifice. All of these conditions have been proposed as indications for cesarean section; however, none have received widespread recognition as such.

The transverse or oblique presentations of the fetus during delivery, particularly such position as might demand podalic version, can, as a rule, in the normal case be handled conservatively without great danger of the development of spasmodic rings in the higher reaches of the cervical portion of the uterus during childbirth which might grasp the aftercoming head and thus endanger the life of the child.

In the hypertrophied cervix of the prolapsed case, however, the edematous, indurated tissues seem more susceptible to irritative influences, such as the repeated manipulations incident to the version, and respond with spasm in the higher portions of the dilated cervical segment. The author cites such an instance in which deep anesthesia, the administration of antispasmodics, or vigorous pulling on the fetus succeeded in relieving the spasm and releasing the aftercoming head. The result was a dead child.

As a result of his experience in the cases reported *in extenso* and in other similar cases, the author concludes that in those instances of uterine prolapse and cervical hypertrophy in which the child is in such a position during delivery as to indicate the necessity of podalic version, the present line of conduct is likely to be modified. He himself believes that it is best in these cases to avoid the necessity for a difficult version maneuver with the danger of fetal death as a sequela; a cesarean operation, done under favorable conditions, would seem to be better.

JOHN W. BRENNAN, M.D.

Extraperitoneal Cesarean Section as a Method of Surgical Delivery in Infected Parturients (Extraperitonealer Kaiserschnitt als Methode der operativen Entbindung bei infizierter Geburt). B. BELONOSCHKIN. *Acta. obst. gyn. scand.*, 1949, 29: 1.

A series of 24 cases is presented to demonstrate the advantages of delivery by extraperitoneal cesarean section in infected parturients. The operation is performed not because of the infection but in spite of it. It is indicated in those cases in which a living infant can no longer be expected via the natural route of delivery, and in which cesarean section would be the procedure of choice in the absence of infection. The danger to the mother is not increased by extraperitoneal section and the number of living infants sacrificed is greatly diminished. The operation was performed in 22 cases of the present series, under spinal tutocain anesthesia.

Extraperitoneal cesarean section should not be performed unless roentgenographic examination indicates the presence of a normal living infant. Operation is facilitated if it is instituted after labor has begun, because the lower uterine segment can then be stretched and the peritoneal plica forced upward, where it can be more easily detected and displaced. A longitudinal median incision is made from below the umbilicus to the symphysis and the sheath of the rectus is split to the symphysis. Division of the fascia to the symphysis will afford more space and freedom of movement. Prior to operation the bladder is filled with 200 c.c. of physiologic saline solution and the catheter is left *in situ* until the bladder has been displaced. After retraction of the bellies of the recti, the left rectus is detached manually from the posterior fascial leaf and maintained in an elevated position with the aid of specula. The left, gloved hand of the operator is introduced toward the left to the lateral horizontal branch of the pubis and advanced deep into the paravesical space. With 4 fingers, the bladder and plica are displaced upward to the right. The bladder is then emptied through the catheter. Blunt dissection of the bladder and plica from the anterior wall of the cervix is easily accomplished.

Following exposure of the anterior wall of the cervix, the uterus is opened through a crescentic incision in the cervicoisthmus region. The head is delivered manually or with the aid of forceps. Following spontaneous or induced expulsion of the placenta and palpation of the uterine cavity, the latter is irrigated with physiologic saline solution and the uterine wound is closed in two layers. The wound cavity in the left paravesical space is likewise rinsed with saline solution, and 10 c.c. of sangostop are injected. A gauze or rubber drain is inserted for external drainage. The abdominal wall is then sutured in layers, an opening being left for the drain.

In most of the cases, the wound in the abdominal wall suppurated, healing only by secondary intention, and the patients were febrile and suffered from endometritis. However, only 1 patient succumbed to puerperal sepsis.

In 4 cases, the plica had been torn before the opening of the uterus and was immediately sutured. In another case a vesical fistula developed but healed spontaneously within 6 weeks. Spinal anesthesia plays an important part in the successful operation, but is of course contraindicated in patients with severe hemorrhage or eclampsia. It is particularly helpful in affording proper relaxation of the abdominal wall, otherwise there may be pressure on the plica by the intestinal loops which would obscure the operative field.

A Porro operation was performed in one case and total extirpation of the unopened uterus was done in another. There were 2 deaths in the series; one occurred in a patient with acute yellow atrophy of the liver, who would most probably not have survived vaginal delivery with sacrifice of the infant. The other death occurred in a patient who developed puerperal sepsis with fatal termination on the tenth day after delivery. The septic focus was found in the left femoral vein. In both cases vaginal delivery would have meant death of the infant and could hardly have been expected to save the life of the mother. There was no case of peritonitis. Of the 24 infants, 2 died. Of these, one was in a state of asphyxia at birth and could not be resuscitated as the operation was done too late. In the second case, resuscitation of the infant likewise proved impossible, and death was attributed to protracted delivery and infection of the uterus at the time of the operation. Both cases emphasize the importance of prompt operation without undue delay, once the indications are present.

Following the extraperitoneal operation there are no intestinal or peritoneal reactions and the patients do not have the appearance of having just undergone a major operation. Food and fluids can be administered shortly after operation and there is a sense of subjective well-being not observed in patients sub-

jected to transperitoneal section. Cesarean section seems preferable to perforation of the living infant in these cases as the danger to the mother is no greater, and it is well known that interventions such as cranioclasis often lead to complications.

In 4 cases extraperitoneal section was repeated. Hitherto repetition of extraperitoneal section has not been mentioned in the literature. These 4 cases are reported in detail.

Should a second extraperitoneal section be indicated, it is wise to perform the operation on the right side. The technique for this procedure is described in detail. Following one or more transperitoneal sections, adhesions form between the uterus and parietal leaf of the peritoneum, but these do not occur following extraperitoneal section. Extraperitoneal cesarean section may be performed on women who have undergone one or more sections, whether transperitoneal or extraperitoneal.

In the first of the 4 patients referred to as having repeated sections, a previous extraperitoneal section had been performed 4 years previously; in the second, two sections had preceded the present extraperitoneal section, one extraperitoneal and one transperitoneal. In the third patient the previous operation was likewise an extraperitoneal intervention done 5 years before, and in the fourth, a transperitoneal cervical cesarean section had been done 3 years earlier. Primary healing occurred in 3 of the patients, and in 1 convalescence was delayed by a slight infection of the operative wound.

EDITH SCHANCHE MOORE.

A 10 Year Study of Cesarean Section in Rochester, and in Monroe County, from 1937 to 1946. JAMES QUIGLEY. *Am. J. Obst.*, 1949, 58: 41.

This report is a statistical survey of all the cesarean sections performed at the 8 hospitals of Rochester, New York, within the 10 year decade ending in 1946. The results are compared with a previously reported survey of the preceding decade.

The incidence of cesarean section was 2.4 per cent in both surveys. Yet the mortality rate in the latter decade (0.94 per cent) was one-third of that noted in the first survey (2.9 per cent). Forty-six per cent of all operations were of the low flap variety and the mortality in this group was one-fifth that of the classical group. No deaths from peritonitis or sepsis followed the low cervical procedure. The morbidity rate was the same in both surveys.

Factors which probably contributed to a mortality rate which was only one-third that of the first study were: (1) 95 per cent of the operations were done by obstetrical specialists (consultation is compulsory in all complicated obstetrical cases in all hospitals); (2) chemotherapy and penicillin were employed; (3) the value of early and sufficient transfusions was recognized; and (4) all patients received better maternal care.

It is more important to consider the contraindications to the operation than the indications.

JOHN R. WOLFF, M.D.

Saddle Block Anesthesia. HERBERT E. SCHMITZ, JANET TOWNE, and GEORGE BABA. *Am. J. Obst.*, 1949, 58: 30.

After two years of experience with saddle block anesthesia, the authors are of the opinion that this method is the most nearly ideal for obstetrical analgesia and anesthesia. The maximum safety to the fetus and mother, the dramatic relief of the discomfort of labor, and the simplicity of the technique make it attractive for the mother, the nursing staff, and the attending obstetrician.

Analysis of 877 attempts at saddle block anesthesia with heavy nupercaine solution at the Lewis Maternity Hospital, in Chicago, showed that complete subjective relief of at least 1 hour's duration was obtained in 93 per cent of these patients. Eighty-six per cent of patients were delivered under the sole analgesic effect of this anesthesia. Subjective relief was of 1 to 2 hours' duration, on the average, but the perineal anesthesia usually exceeded 3 to 4 hours' duration. In 123 patients, supplementary anesthesia was given to supplement waning spinal effect, and for deeper anesthetic to permit operative maneuver, or for psychological reasons only. The time of administration was the late first stage or early second stage of labor. The incidence of operative deliveries was low.

There are certain potential dangers to the use of this type of anesthesia that must be borne in mind at all times. Protracted or permanent neurologic complications may follow spinal anesthesia as well as general anesthesia. Foot drop developed in one instance. One patient exhibited a drug sensitivity. Eighteen per cent of patients developed a transitory fall in blood pressure. Fourteen per cent complained of postspinal headaches. It is imperative that the most careful technique be meticulously observed. All precautions must be taken to guard against any danger. An experienced obstetrician can minimize the factors contributing to the potential danger. For such individuals, saddle block anesthesia provides the most nearly ideal form of anesthesia.

JOHN R. WOLFF, M.D.

NEWBORN

Treatment of Hemolytic Disease of the Newborn by by Exsanguination-Transfusion, With or Without Birth Induced Before Term; Study of Therapeutic Indications and of Results on the Basis of 34 Cases (Traitement de la maladie hémolytique du nouveau-né par l'exsanguino-transfusion, avec ou sans accouchement provoqué avant terme; étude des indications thérapeutiques et des résultats à propos de 34 cas). S. BUHOT. *Rev. hémat.*, Par., 1949, 2: 246.

In the absence of specific treatment of maternal isoimmunization, therapy of the hemolytic disease of the newborn disposes of two complementary, theoretically efficacious methods: birth induced before term, and exsanguination-transfusion as complete and as early as possible. Birth induced before term, the aim of which is to allow exsanguination-transfusion before the occurrence of irreversible le-

sions, appears to be truly useful. However, the determination of its date, which must take into account the dangers inherent in prematurity and the gravity of the fetal involvement, is difficult. Therefore, it is often necessary to select a priori a rule to follow. Buhot has adopted the rule of inducing birth in the beginning of the ninth month, which seems to be the best compromise between the danger of the disease and that of prematurity; but this rule undergoes two eventual modifications: (1) when the familial history shows fetal deaths before this date or when significant serologic changes occur, birth may be advanced with success to the middle of the eighth month; (2) when the heterozygotism of the father is proved and there is no suspicious phenomenon, birth may be delayed to the second half of the ninth month.

Exsanguination-transfusion is indicated immediately after birth as soon as the clinical, hematologic, or serologic examination has demonstrated that the newborn has the disease. It is advisable that these three examinations be performed simultaneously by three different persons so that a minimum of time elapses between the birth and the intervention. When the disease is recognized more than 24 hours after birth, the indications of exsanguination-transfusion are less precise, but it appears advantageous to extend them to all cases in which it seems that the evolution may not be favorable spontaneously or after plain transfusions.

The technique of the exsanguination-transfusion of Diamond by the introduction of a supple catheter through the umbilical vein up to a large vessel is satisfactory because of its simplicity and usual innocuity. When the cord is necrotic, the catheter may be inserted into the denuded internal saphenous vein.

To interpret the therapeutic results, Buhot has classified his 34 cases on the basis of the clinical condition of the child at the time the exsanguination-transfusion was performed. Group 1 includes the infants treated before the appearance of clinical signs of the disease; group 2, those treated when the disease was clinically evident but without grave signs; group 3, those treated in the terminal stage of the disease, presenting grave signs which came under three principal syndromes: (1) the nervous syndrome which differs from that of nuclear icterus and shows signs of diffuse involvement of the central nervous system, consisting of somnolence and lack of reaction to the examination, adynamia, hypotony, and reduction of the tendinous reflexes; (2) the hemorrhagic syndrome consisting of purpura of varying degrees and hemorrhages of the digestive tract mostly represented by oral ejection of blood-tinged or frankly bloody fluid; and (3) the edematous syndrome.

Group 1 included 9 cases with 1 death (11 per cent) and 8 cures (89 per cent); group 2, 15 cases with 2 deaths (13 per cent), 11 cures (73 per cent), and 2 cases with slight sequelae (13 per cent); group 3, 10 cases with 8 deaths (80 per cent), 1 cure (10 per cent), and 1 case with sequelae.

The cases belonging to the first two groups are considered as curable by exsanguination-transfusion, but with the possibility of sequelae; those of the third group have a bad prognosis, but exsanguination-transfusion, although generally ineffective, must be tried. This method may be regarded not only as preventive but also to some degree as curative. It certainly constitutes a marked progress over ordinary, even early and repeated, transfusion.

RICHARD KEMEL, M.D.

MISCELLANEOUS

The Serum Cholinesterase in Gynecology and the Normal and Pathological Processes of Pregnancy (Contributo allo studio della colinesterasi serica in ginecologia e nella gravidanza normale e patologica). MARIO PAGLIARI. *Ginecologia*, Tor., 1949, 5: 203.

The author conducted research studies in conformity with Laborit and Morand's method on the variations of serum cholinesterase in gynecology, obstetrics, labor, and the pathological processes of pregnancy, and he concluded:

1. During menstruation, the amount of serum cholinesterase varied according to the stage of the menstrual period. A decrease was seen during the proliferative phase, and an increase was seen during the secretory phase.

2. During the menopause, in women with polyhormonal metrorrhagia or amenorrhea, low values were seen which became normal after long periods of treatment with testosterone and corpus luteum hormone. The same values were seen after 3 days of prostigmine and thiamine hydrochloride therapy.

3. During pregnancy, lowered values were seen throughout all three trimesters.

4. During labor, a decrease in cholinesterase was seen, which increased during the puerperium to reach the normal amount on about the fifteenth day.

5. In the pathological complications of pregnancy, variable amounts were found to be present in the various types studied. Increased values were seen in cases of asthma and diabetes mellitus; in cases of eczema, urticaria, and in the toxemias of pregnancy (hyperemesis, renal disease, icterus) lowered values were seen. In cases of eclampsia with hypertension an increase of the diastatic amount was seen, which returned to normal following delivery.

JOSEPH P. CASCINO, M.D.

Free-Feeding Pregnant Women. ARTHUR G. KING. *Am. J. Obst.*, 1949, 58: 299.

In a study of 226 cases, a group shown to be statistically adequate, no restrictions on caloric intake were placed during the entire pregnancy. The average weight gain was 24.4 pounds (standard deviation 6.7) and the retained weight, or net gain, at the end of 3 months postpartum was 2.0 pounds (standard deviation 6.3). The correlation between the total gain and the net gain was low, the coefficient being only 0.5, which indicated that only 25 per cent of the

retained weight is related to the number of pounds the woman gains during pregnancy.

A gain of weight in excess of the standard is due to either or both of two conditions: an exaggeration of the positive water balance and developing obesity. Excessive weight gain due to water retention may be a manifestation of subclinical toxemia of pregnancy, and it disappears completely during the late puerperium. Reduction of the caloric intake of such patients will have little effect on this cause of weight increment, and may do harm if necessary protein is withheld in proportion to the storage of water in an effort to keep the weight down.

The incipient or developing obesity is a psychologic problem, and may be a compensation for insecurity or anxiety either induced or intensified by the pregnancy. Deprivation of the oral satisfaction of eating merely compounds the basic psychologic problems, particularly if done in a dominant, threatening, or punitive manner. Control of the overeating by a diet list and instructions is effective only if the psychologic drive to eat is slight. The explanation and attention given to obtain the patient's co-operation constitute a form of psychotherapy, and in simple cases may be all that is necessary. Superficial psychotherapy, usually adequate, is within the scope of most practitioners of obstetrics, and consists of giving the patient true confidence in her doctor and in herself, allaying her fears and anxieties, and establishing in her a mature, optimistic orientation.

GEORGE BLINICK, M.D.

Occult Omphalitis and Its Practical Significance (Die okkulte Nabelentzuendung und ihre praktische Bedeutung). HERBERT CRAMER. *Geburtsh & Frauenh.* 1949, 9: 98.

A study with collaboration between the internist, pediatrician, and pathologist has been going on in Frankfort on the Main, Germany, in an attempt to clarify the causes of the disturbing infant mortality during the war and postwar years. A considerable amount of this mortality (64%, according to Wachter) has been traced to a deep-seated covert form of infection of the newborn navel, the presence of which could not be determined macroscopically. The author is now ready to report his findings and conclusions based on the examination, at autopsy, of 35 infants.

The criteria by which it was adjudged that these 35 cases were not instances of the almost physiological inflammatory processes incident to the casting off of the cord and the healing of the resultant wound, and that the cases of delayed healing of the umbilical wound were not the result of the poor dietary and hygienic conditions of this period, consisted of the finding of arterial and periarterial histiocytic, suppurative, or necrotic suppurative changes, following the umbilical vessels deeply down toward the symphysis. Such changes were discoverable in many cases only by means of the microscope in serial sections. The condition was almost always an arteritis or periarteritis; in only 2 instances was there a concomitant umbilical phlebitis. In 1 case the phlebitis was the only lesion present.

The manner in which the umbilical process disseminated to affect the general health of the child was via peritonitis in 5 of the 35 cases; the peritonitis was diffuse in 3 and localized to the umbilical fossa in 2 cases. In 12 cases the spreading process appeared as a pyemia with secondary septic localizations scattered indifferently throughout the arterial vascular system (pleura, myocardium, pericardium, kidneys, joints, bones, wall of stomach, skin, pia mater); in 2 the dissemination was in the form of a peculiar epithelial nodule formation, in one instance scattered throughout all the organs of the body, and in the other limited to the liver; however, it was always in recognizable relationship with the blood vascular system. However, most frequently, (16 cases) the general response to the localized lesion in the umbilicus was a parenteral dyspepsia, passing through the phenomenon of dystrophy to end up as a generalized atrophy of the affected infant. Two forms of this dyspeptic response have been described: a stealthy, insinuative, subacute form and an acute form appearing as a dyspepsia and rapidly leading to a severe toxic state.

The treatment proposed for this condition is both prophylactic and curative. A study was made of the efficiency of various antiseptics and antibiotics in shortening the period required for the drying up and casting off of the cord: it was found that with a dressing using penicillin the cord was discharged in an average of 4.88 days; using alcohol, 6.72 days; balsam of Peru, 6.72 days, and marfanil powder, 10.25 days. In the curative treatment the sulfonamides have been used the most extensively; however, such experience as has been gained with penicillin and its demonstrated efficiency in a prophylactic sense are very encouraging. Anyhow, with the improvement in living conditions of the last year or so in this part of Germany the incidence of this form of omphalitis has been steadily decreasing.

JOHN W. BRENNAN, M.D.

Results of Bilateral Ovarian Wedge Resection in 47 Cases of Sterility. IRVING F. STEIN, MELVIN R. COHEN, and RALPH ELSON. *Am. J. Obst.*, 1949, 58: 267.

Although bilateral polycystic ovaries are not one of the common causes of sterility, they are one cause which is amenable to surgical treatment. Eighty-five per cent of the authors' married patients in whom bilateral polycystic ovaries were diagnosed had a primary complaint of sterility. It is evident that sterility is an important component of the polycystic ovary syndrome. Sixty-five per cent of the women who were sterile due to this condition have been successfully treated by bilateral ovarian wedge resection and pregnancy has occurred. Hence, sterility due to this ovarian disturbance has a high rate of curability.

Menstrual function was satisfactorily restored in 89.3 per cent of the 75 patients operated upon. These

patients were carefully followed up ever since 1929 when the first resection was done. The patients returned for re-examination and sent in menstrual calendars annually to complete the records.

The hypoplastic uterus responded to the secondary sex stimulation, as did the hypoplastic breasts. Usually, hirsutism was not favorably affected. In a few patients, however, excess hairy development disappeared to a remarkable degree.

The patients who appeared depressed and frustrated when amenorrheic and presumably sterile showed a remarkable emotional improvement with the establishment of normal menstruation and particularly after pregnancy occurred.

The student of sterility should become cognizant of the implications of the polycystic ovary syndrome, utilize pneumoperitoneum for corroboration, and perform bilateral ovarian wedge resection to obtain the best results in the treatment of bilateral polycystic ovaries. CHARLES BARON, M.D.

Clinical Report of the Coombe Lying-In Hospital. EDWARD A. KEELAN, S. MACLAVERTY, and J. DOYLE. *Irish J. M. Sc.*, 1948, Ser. 6, p. 441.

During the year of 1947, 804 patients were delivered in the maternity wing of Coombe Lying-in Hospital and 1,600 patients were delivered in the district. The main problem in the hospital was lack of adequate accommodation for the patients. Occasionally, patients had to be cared for on the district that should ideally have been admitted to the hospital. There were 59 cesarean sections done in this group of 2,404 deliveries; 29 of these were repeat cesarean sections, giving a combined rate of 3.2 per cent. All operations were done through the lower segment. Among the new cesarean sections, indications for operation included disproportion, which occurred in 16 cases. The morbidity rate calculated on the British Medical Association standard was 2.16 per cent. The mortality rate was 0.15 per cent of all deliveries. There were 3 maternal deaths on the Interne Service: 1 of these after abdominal hysterotomy for toxemia, 1 as the result of uncontrollable postpartum hemorrhage after cesarean section, and 1 as the result of intracapsular hemorrhage in a case of essential hypertension with severe preeclampsia. There were 2 maternal deaths in the district, both due to pulmonary embolisms which occurred quite suddenly during the puerperium. On the Interne Maternity Service there were 57 stillbirths and 34 neonatal deaths; 23 of the neonatal deaths were in premature infants.

In the Gynecological Department, 291 operations were performed throughout the year. These included 53 hysterectomies, 19 of which were total; 25 were subtotal and 9 were vaginal hysterectomies. There were 2 deaths on the Gynecological Service. One followed a Manchester operation. During the operation the patient had severe bleeding, and although blood transfusion was maintained the patient failed to rally and died 5 hours after operation. The second death occurred in a patient whose condition when sent in was given as a probable malignant ovarian cyst. However, because of the patient's generally poor condition, operation was not performed, nor was a postmortem examination made. The report of the Pathological Department was also included in this article. HARRY FIELDS, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Androgenic Tumors of Adrenal Cortex. GEORGE F. CAHILL and JOHN N. ROBINSON. *J. Urol.*, Balt., 1949, 61: 680.

The signs and symptoms of adrenocortical tumors in children vary according to the type and amount of hormone produced, and according to the age and sex of the patient. The changes most frequently observed are due to excess androgens; next most frequent are those due to combined androgens and estrogens; metabolic changes resembling those in Cushings disease in the adult are third; and rarest of all are those due to excess estrogens.

The authors present 4 cases of adrenocortical tumors in children with androgenic symptoms, one of whom also presented mixed metabolic symptoms. Signs of cortical hyperactivity that are acceleratingly progressive at a certain age, in children who have been normal from birth, should suggest the presence of adrenocortical tumors. Adrenogenital syndrome with bilateral adrenal hyperplasia and female pseudohermaphroditism must be differentiated. In the former, symptoms progress more slowly; in the latter, the condition is present from birth. The urinary 17-ketosteroids are elevated in tumors of androgenic activity. The amount is proportional to the size of the tumor. Urinary 17-ketosteroids may be elevated in bilateral adrenal hyperplasia. At present, differentiation of carcinoma, benign tumor, and hyperplasia of the adrenal cortex by their urinary end products is not feasible.

Air insufflation and adrenal roentgenograms are useful in differentiation of anatomically normal adrenals, adrenal hypertrophy, and adrenal tumor. In normal adrenals, the size and shape are so shown; in hypertrophy, the shape is that of a normal adrenal but the size is greater; in the presence of tumor, the mass is round or ovoid and not infrequently calcified. In the presence of progressive adrenocortical hyperactivity with negative perirenal air studies, transperitoneal exploration and biopsy of the adrenals is indicated. DOVELL N. BONNETT, M.D.

"Trueta" Renal Vascular "Shunt." W. E. GOODWIN, R. D. SLOAN, and W. W. SCOTT. *J. Urol.*, Balt., 1949, 61: 1010.

The experimental study of the crush syndrome undertaken by Barnes and Trueta in 1941 suggested that there was a neurovascular control of the renal circulation. The present study is concerned with the author's efforts to confirm or deny certain phases of the Trueta experiments, and with extending their observations to man and other animals.

A brief review of the anatomy and physiology of the kidney from the time of Bowman to the work carried out by Talso *et al* in 1948 is included in this article.

The authors' study consisted of their observations on 40 rabbits, 40 dogs, 4 cats, and 4 monkeys.

The loci of stimulation were: leg tourniquet for 4.5 hours, cerebral stimulation of the cut left sciatic nerve for varying periods of time up to 4.5 hours, stimulation of the greater splanchnic nerve, both divided and intact, and stimulation of the intact thoracic sympathetic chain and splanchnic nerves in the area D9–11. The peripheral ends of the carefully divided plexus of nerves originating in the greater and lesser splanchnics and surrounding the renal artery were also stimulated.

After nerve stimulation had been applied for the desired time, an estimation of the renal circulation was made by any or all of three ways: (1) by direct observation of the kidneys for cortical blanching; (2) by intravenous or intra-arterial injection of a vital dye; and (3) by x-ray visualization of the vascular system which was suddenly filled with thorotrast that had not been cleared by the kidneys.

From their experimental studies the authors have observed that the medullary vascular pathway of a kidney may assume the chief burden of the renal circulation under certain conditions, leaving the cortical circulation and the bulk of the glomeruli ischemic for the duration of the stimulation.

The clinical considerations of this type of experiment as applied to man should be of considerable interest to the urologist.

Studies of the human sympathetic nerve supply to the kidneys and ureters reveal ample anastomoses between all parts of the system, beginning with the greater and lesser splanchnics and extending downward to the lower ureters and the pelvic plexus.

Wharton, in 1932, investigated the puzzling problem in intractable and unexplainable renal and ureteral pain. A glance at the tracings of his dissections in the light of the neurovascular reflex suggests a possible answer to the mechanisms of "reflex anuria."

In patients there is often a rapid refilling after emptying an overdistended bladder. Perhaps, a full bladder sets up a neurovascular stimulus by way of the autonomic nervous system surrounding the bladder and ureters; thus, a decrease in urinary output is produced under these conditions.

There may be a urological application of this neurovascular reflex in the lower nephron nephrosis following hemolytic reactions associated with transurethral prostatic resection. The authors' experiments seem to indicate that the triad of shock, splanchnic nerve stimulation, and hemoglobinemia will produce the lesion clinically and pathologically, whereas any one of the three taken separately or in pairs will not produce this condition.

Experiments on Homer Smith, a patient, suggested to him the relation between pain and emotion upon the renal blood flow.

Pain, too, has been studied in this connection. George Wolf found that after a normal control period, a painful stimulus (usually a band around the head) would cause a marked drop in the diodrast (tubular function) clearance and a less marked decrease in the inulin (glomerular filtration) clearance. This change may have been caused by a neurovascular reflex; yet its mediation is unknown. At the present time it may be best to explain it by a transient renal ischemia.

The severe nature of the stimuli used in their experiments suggested to the authors that the cortical ischemia thus produced was a pathological rather than a physiological entity. Only in conditions of extreme nerve stimulation would this mechanism, if it exists in man, be invoked, perhaps as a kind of protective mechanism for the rest of the body.

It is just such severe stimulations that are encountered in crush injury, overwhelming surgery, traumatic abdominal injuries, marked bleeding, and electrosurgical stimulation that is used in transurethral prostatic operation.

If further functional studies prove that renal vascular shunts are normal physiological mechanisms—more or less active in ordinary circumstances and changing momentarily to meet the needs of the individual—some of the variations in renal function so frequently observed would be explained.

The authors concluded that under the conditions of their experiments, renal nerve stimulation produced renal ischemia. The juxtamedullary glomeruli would then carry the blood flowing through the kidneys at the expense of the cortical glomeruli which would become ischemic. The distribution of renal blood may be under the control of a neurovascular mechanism. CONRAD A. KUEHN, M.D.

Mixed Hypernephroid Tumors (Metanephromas). C. G. TEDESCHI, W. H. HOLTHAM and C. L. MINOR. *J. Urol.*, Balt., 1949, 61: 981.

The discussion of mixed tumors of the kidney is usually concerned with the well individualized hamartomas, hamartoblastomas, and the malignant neoplasms observed in children. These tumors in children are composed of a variety of mesenchymal tissues as well as glandular tubular formations.

The authors reported and described 5 cases of another type of renal tumor that occurred chiefly in adults, but because of the complexity of its structures it was classified as a mixed tumor, as it occurred in a manner not unlike that of the "mixed tumor of childhood."

In all 5 of the cases the renal tumor growth was characterized by a complexity of tissue patterns resulting from the presence of a variety of epithelial and mesenchymal structures in inharmonic aggregation.

Pleomorphoembryonal connective tissue cells, lipoblastic tissue, myxomatous tissue, smooth muscle, nerve fibers, and glandular tubular tissue were the main constituents of the growth in the first case. Two unusual features of this case were the absence of urinary symptoms and the advanced age of 63 years when the tumor was discovered.

Dark granular epithelial cells, either in solid, compact arrangement or in papillary formations, were the main characteristics of the tumor found in the second case. The tumor might have been considered a papillary growth, overshadowed by a tissue of adrenal-like potentialities; however, it was of a more complex nature as shown by areas with broad invasion of spindle-shaped sarcomatous cells.

The main structural pattern of the tumor in the third case closely resembled that found in the second, with its diffuse infiltration of dark granular cells in irregular papillary aggregation. A diagnosis of papillary adenocarcinoma was not made because the tumor contained areas of typical angiosarcomatous cells and a broad infiltration by embryonal mesenchymal cells. The mixed epithelial and mesenchymal nature of the growth was further proved by a well circumscribed lipoblastic nodule imbedded in the bulk of the growth. The transitional cytologic patterns could be recognized between undifferentiated mesenchymal and mature fat tissue cells.

The resemblance to suprarenal gland tissue was striking in the fourth case because of the polyhedral form of the cells, their distinct outlines, the clear aspect of the cytoplasm, the smallness of the nuclear plasmatic ratio, the columnar arrangement of the cells, and their intimate relations to the sinusoidal capillaries. There was a disorderly distribution of thin-walled blood vessels in intimate connection with the tumor cells that suggested an angioblastomatous growth.

In the fifth case the prevailing pattern was that of a proliferation of epithelial cells which both in arrangement and intimate structure simulated suprarenal gland tissue. An aberration of the usual structure of the suprarenal gland was represented by pseudoglandular tubules. The tumor was not a true hypernephroma, as shown by the presence of irregularly dispersed mesenchymal structures with areas consisting chiefly of cells that had the characteristics of myxosarcoma and areas with thick bundles of smooth muscle.

It is suggested that both categories of tumors—the mixed hypernephroid or metanephroma and the Wilms—have their origin in the pluripotent, undifferentiated mesoderma. The period of differentiation in which the dysplastic process takes place in the metanephric blastema is most likely the factor determining a Wilms' tumor or a mixed hypernephroid tumor with the unpredictable variety of structures so characteristic of these "mixed" renal growths.

CONRAD A. KUEHN, M.D.

Squamous Cell Carcinoma of the Renal Pelvis. H. Q. GAHAGAN and W. K. REED. *J. Urol.*, Balt., 1949, 63: 139.

Gahagan and Reed report 3 cases of squamous cell carcinoma of the renal pelvis in patients 72, 70, and 76 years old. They found 106 similar cases reported in the literature.

The incidence of the condition is equal as to the sexes and the sides involved; the average age of the patient is 55 years. A correct preoperative diagnosis has never been made. Infection is commonly associated with this condition, and 48 per cent of the patients had an associated renal calculus.

The prognosis is very poor, and no 5 year cures have been reported. DAVID ROSENBLOOM, M.D.

Parenchymal Carcinoma of the Kidney. I. H. GRIFFITHS and A. C. THACKRAY. *Brit. J. Urol.*, 1949, 21: 128.

The authors review 103 cases of renal parenchymal carcinoma. Sixty patients were subjected to surgery, in 20 the lesions were found to be inoperable, and the remainder (23) came to the postmortem room undiagnosed.

An analysis of the clinical features reveals that pain, hemorrhage, and tumor, the well known triad associated with renal malignancy, usually occur together only in advanced cases; 17 manifested this syndrome. Pain occurred alone in 10 cases, while in 8 cases a tumor was the only symptom. Hematuria was a feature of nearly 50 per cent of the cases and was the sole complaint in 19 of the patients. In 17 patients the only signs and symptoms were caused by metastasis, and in 8 cases there were no signs or symptoms whatsoever.

Loss of weight was manifested in only 16 cases of the whole series.

Pyrexia was the main complaint of 12 patients and in the instances in which operation was carried out there was usually a large necrotic renal growth. The importance of prolonged pyrexia as a prognostic sign is its fairly constant association with a large necrotic tumor likely to provide considerable difficulty at operation.

Right-sided varicocele, a condition said to suggest the presence of a renal tumor, was found in only 1 of the cases; in another case a left varicocele was present.

Hypertension was a finding in approximately 9 per cent of the cases studied. The patients in this group did not survive long enough for any effect of nephrectomy on the blood pressure to become apparent.

Twenty per cent of the patients were first admitted with symptoms or signs arising in the metastasis of an otherwise silent primary growth of the renal parenchyma. An analysis of these lead to the conclusion that severe pain in the back with hematuria should make one suspect a renal tumor even in the absence of obvious enlargement of the kidney.

An attempt was made to find some pathological characteristics which would be of prognostic value. The tumors were divided into two groups according to whether clear or granular cells predominated, but analysis of the survival times of the two groups showed no significant difference. The appearance of the cell cytoplasm would therefore appear to be of little prognostic significance. However, the arrangement of the cells was shown by a similar preliminary assessment to be of far greater importance. The authors finally adopted a system of classification by grading according to a series of histological features indicative of malignancy. This was based on a classification employed by Patey and Scarff in their investigation of carcinoma of the breast. Three criteria of malignancy were taken into account: the degree of papillary or adenomatous formation, the irregularity or variability of the cells, and the frequency of mitoses and hyperchromatic nuclei. For each of these features points were allotted, and the total determined into which of three grades of malignancy the tumor would fall. There are no clear-cut divisions between the grades; the tumors are, as it were, arranged in a graded series of malignancy from which an arbitrary number of groups (three) is made, representing low, moderate, and high malignancy.

Analysis of the material showed that there was a definite correlation between the histological grade and the prognosis.

Carcinoma of the renal parenchyma may invade adjacent structures directly or may spread by the lymphatics like any other carcinoma. Its most important route of dissemination is by the blood stream. If the renal vein is found at operation to contain tumor and thrombus, the prognosis is grave.

Plain roentgenograms were of little assistance in making the diagnosis of renal tumor. Calcification may be apparent on the film but is a rare occurrence. It was seen in only 4 of the cases and in 2 of these a misdiagnosis of calcified mesenteric cyst was made because of the roentgenographic appearance.

The authors believe that the intravenous urogram was of the greatest value in making the diagnosis, estimating function, and assessing the prognosis. The usual picture is one displaying distortion, distention, deformity, and a filling defect of one or more of the calyces or the pelvis.

A retrograde pyelogram should always be made as a check on the intravenous pyelogram, for in it the shadow is denser and the deformity, if present, is exaggerated. The outline of the calyces may be more clearly defined and the course of the ureter more easily traced.

The treatment of carcinoma of the kidney is primarily surgical, and operation must be performed as early as possible if a cure is to be achieved. The authors prefer the lumbar approach, observing the usual cautions to prevent the freeing of malignant emboli.

Deep x-ray therapy was seldom used as a preoperative measure, and in only 1 case was the result at all impressive.

Palliative deep x-ray therapy was given as a routine measure in the inoperable cases, but with no evidence of reduction of the rate of spread of the growth although there did seem to be some alleviation or even complete relief of pain.

Postoperative x-ray therapy was used in a small number of cases, too small to show any significant

differences in the survival rate, and the value of postoperative roentgen therapy could not be assessed from this material.

Of the 60 patients subjected to nephrectomy, 77 per cent survived 1 year, 56 per cent 3 years, 47 per cent 5 years, and 21 per cent 10 years.

The prognosis in any case depends on the inherent malignancy of the tumor, that is, its rate of growth and propensity for dissemination, and the extent to which it has already spread. If there are no indications of extension of the tumor the prognosis is more favorable. Histological grading is important as it indicates the likelihood of dissemination which has occurred before the operation and is some indication of how long the patient will live after the operation if tumor tissue remains in the body.

The authors emphasize that to formulate a prognosis one must consider all of the various factors in conjunction and not one alone, and it is for the surgeon to assess the several factors in any given case and arrive at a prognosis by a mental summing up rather than a mathematical calculation.

ROBERT C. BEADLES, M.D.

Diverticulum of the Ureter. MORTON M. MAYERS. *J. Urol.*, Balt., 1949, 61: 344.

Diverticula of the ureter are divided into two main categories: (1) the true diverticulum, formed by a protrusion of the entire wall, and (2) the false diverticulum, caused by protrusion of the mucous membrane through the muscular coats. The true diverticula are apparently congenital, while the false diverticula are acquired. Eighteen substantiated cases, 12 being true diverticula (including one case presented by the author), are set forth in tabulated form.

There is nothing specific about the symptoms, the diverticula being either the seat of a calculus or the cause of obstruction with consequent renal damage and urinary infection. Diagnosis is made at operation, by pyelographic study, or at autopsy. The treatment varies from none to cystoscopic ureteral dilatation or surgery. Surgery consists of either diverticulectomy or nephrectomy.

The case report of a true ureteral diverticulum containing a calculus, and diagnosed by the author, is presented. Recovery, with clear urine and only minimal pyelectasia on the involved side, followed transvesical ureterolithotomy and diverticulectomy.

JESSE W. SHAW, M.D.

Ureterovesicostomy as a Treatment of Congenital Stenosis of the Lower Part of the Ureter. HARALD ABRAHAMSEN. *Acta chir. scand.*, 1949, 98: 157.

In contrast to a rich literature on pathologico-anatomical changes at the ureteropelvic junction, there has been a sparsity of material on anomalies of the lower ureter. Congenital stenoses in this region are relatively frequent, yet the majority of cases are not diagnosed until a pronounced hydronephrosis or pyonephrosis with irreparable kidney damage has developed.

In a 10 year period there were 14 such lower ureteral stenoses seen at the Bispebjerg Hospital, Copenhagen. Changes found at operation were almost identical. The dilated ureter was attached to the peritoneum and bore a striking resemblance to small intestine. The diameter of the upper part was variable, most often that of a finger. The distal portion was embedded in fibrosed tissue which, on removal, showed a cordlike ureteral segment the thickness of a knitting needle. The transition from dilated ureter to stenosed ureter was either gradual or abrupt. In 2 cases of intramural stenosis, the dilatation extended down to the bladder. In 7 of the remaining 12 cases there was a pulsating cord coursing from the apex of the bladder along the upper and lateral surfaces, then bending almost at a right angle downwards and outwards, and continuing to the hypogastric vessels. In his dissections, the author had the impression that this structure, very likely a persisting umbilical artery, compressed the lower ureter.

In making a diagnosis, visualization of the ureter in its entire length is necessary. The distal part of a thin ureter may be concealed by the bladder shadow in intravenous urography, but is visible in retrograde study. This finding of stenosis rather than cystoscopy, which does not demonstrate any changes at the ureterovesical opening, differentiates this condition from "megaloureter."

Unlike the inflammatory stenoses of adults, this congenital fibrotic narrowing does not respond to bougie dilatation. The usually young age of the patient would make it very difficult to carry through such treatments. For efficient kidney drainage, the author performs an anastomosis between the ureter and the bladder, i.e., a ureterovesicostomy. Simple release of the vascular cord compression is insufficient. This latter procedure, carried out in one case, did not relieve the marked ureteral dilatation and infection, and led to nephrectomy. The anastomosis was carried out on 14 patients, 10 of whom were children between the ages of 11 months and 11 years. In 12 of the 14 cases the anastomosis was carried out like an ordinary side-to-side gastroenterostomy, and in 2 cases as an end-to-side anastomosis, the cut, dilated stump being implanted directly into the bladder. After completion of the first part of the anastomosis, a previously introduced ureteral catheter is pushed up the ureter. The anterior part of the union is then completed. Finally, a layer of fatty tissue is sutured over the anastomosis and drainage is provided. Daily pelvic lavage is performed for 10 days, following which the catheter is removed. During this period and for a short period afterwards, chemotherapy is liberally administered. Wound healing was complete in 2 or 3 weeks from the day of operation.

A follow-up table is presented for periods up to 10 years; the findings on intravenous urography, and the status of the urine are listed. In almost all cases the urine was sterile. There were a few leucocytes in 2 cases. This improved status of the urine with

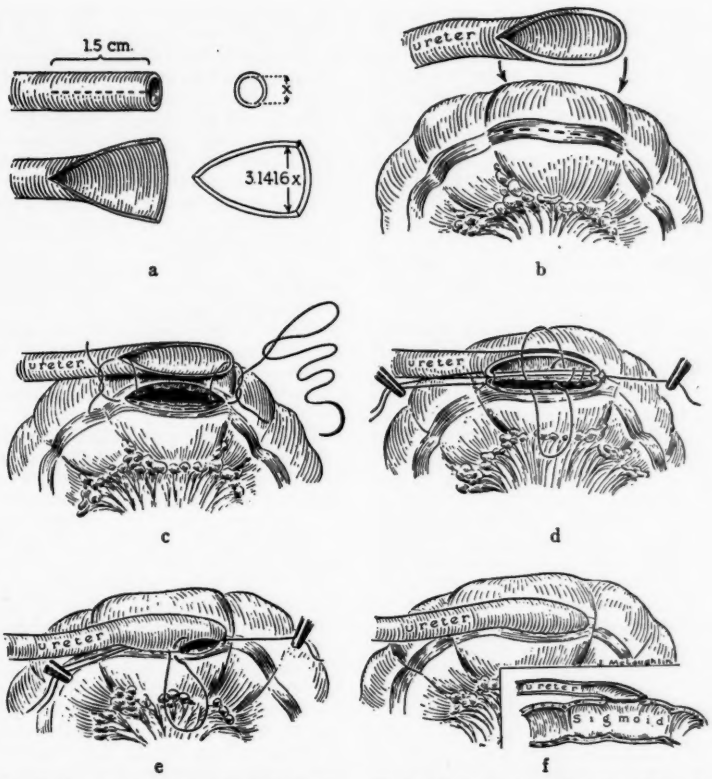

Fig. 1 (Nesbit). Ureterosigmoidal anastomosis by direct elliptical connection. a, Spatulate opening allows elliptical attachment to bowel. b, Smallest diameter of ellipse is 3.1416 times that of ureteral lumen. c, Anchor sutures to approximate in parallel the two openings. d, First half of anastomosis sutured from inside. e, Second half of anastomosis sutured from outside, inverting the mucosae. f, Illustrates the completed anastomosis by one continuous suture line, producing elliptical connection.

relief of stagnation is the important result clinically. Those patients examined cystoscopically, after operation, showed satisfactory ureteral openings with rythmic contractions of the ostium and emissions of urine. In a few cases the dilatation of the ureter and pelvis disappeared completely. In others there was a continued mild, persistent dilatation which was not significant in the absence of infection and stagnation.

ALLAN K. SWERSIE, M.D.

Ureterosigmoid Anastomosis. REED M. NESBIT. *J. Urol.*, Balt., 1949, 61: 728.

A new technique of ureterosigmoidostomy has been tried by the author on dogs and on 5 human beings with success. The patient is prepared for one week with enemas every other night and magnesium sulfate catharsis on alternate days. Four grains of sulfathalidine are given daily. For 2 days before surgery and 10 days after, 1.0 gm. of streptomycin and 300,000 units of duracillin are given daily intramuscularly. Intratracheal anesthesia allows use of the Trendelenberg position in surgery.

The new technique attempts to prevent fibrosis of a ureteral stump projecting into the bowel lumen and fibrosis in a tunneled area of the bowel wall, the principal hazards of previous methods of anastomosis. The ureter on each side is exposed by incising the pelvic peritoneum over it and is cut between clamps close to the bladder. The proximal end is made spatulate by a single longitudinal incision 1.5 cm. long. An incision of the same length is made longitudinally in a taenia of the sigmoid. A running suture with an atraumatic needle on 5-0 chromic catgut approximates all coats of the edge of the ureter to all coats of the bowel, the result being a partial side-to-side anastomosis as shown in Figure 1. The peritoneum which was incised to immobilize the ureter is sutured, a loose opening being left where

the ureter emerges. The sigmoid is fixed to the lateral pelvic wall by several interrupted sutures.

None of the 5 patients in whom this technique was used developed peritonitis. Only 1 had transitory pyelonephritis. Preoperative and postoperative pyelograms on all patients are shown. Only 2 ureters showed minimal postoperative dilatation. Unilateral hydronephrosis in 1 case regressed postoperatively. REED ROSS HAEGER, M.D.

BLADDER, URETHRA, AND PENIS

Urachus and Bladder Actinomycosis. M. PESQUEIRA and R. LÓPEZ ENGELKING. *J. Urol.*, Balt., 1949, 63: 163.

Actinomycosis rarely involves the bladder and most uncommonly the urachus, but it is somewhat more frequent in the kidney than in the bladder. The pathogenesis of the disease involves initial buccal mucosal infection as well as trauma to various areas of the skin. The infection in the urinary tract may be either primary or secondary to hematogenous spread in cases of gastrointestinal, ovarian, pulmonary, or skin lesions. In the case presented, a history of primary infection was unobtainable but it was believed that the infection occurred through the umbilicus. Urologically, the diagnosis is established by finding the ray fungus in the urine or the secretion from the pin fistulas.

The case reported involved a 48 year old man who complained of a burning sensation around the umbilicus with radiation to the loins and flanks. A hard painful mass developed in the lower abdomen but there were no accompanying urinary symptoms except nocturia which had occurred five times. The examination was entirely noncontributory except for a tumor mass in the lower abdomen which was tender, firm, measured about 10 cm. wide and was apparently attached to the umbilicus and bladder dome. Cystoscopically, a tumor 1.5 cm. wide of villous appearance and dark red in color was localized over the dome and surrounded by an area of edema and mucosal congestion. The cystoscopic diagnosis was urachus tumor. The laboratory examinations were noncontributory. A cystogram showed a contracted bladder and a filling defect over the lateral recesses of the bladder. The tumor mass was surgically excised and a partial cystectomy was done at the same time. Pathologically, the tumor mass measured 15 by 6 by 4.5 cm. and revealed actinomyces ray granules histologically. PETER L. SCARDINO, M.D.

Symposium: Carcinoma of the Bladder. ARTHUR JACOBS, E. W. RICHES, and J. L. E. MILLEN. *Brit. J. Radiol.*, 1949, 22: 393.

JACOBS: Cancer of the bladder can be attacked by a variety of methods. Diathermy is accepted as the method of choice in the treatment of pedunculated villous papilloma, a tumor regarded as benign in character. It can also be employed as a method of treating sessile malignant papillary tumors, the projecting portions of the growths being reamed off by the cutting current and the resultant base then thoroughly electrocoagulated. The flat infiltrative tumors can be treated and the immediate results are usually good; however, it is palliative only, the tumors generally reappearing within 2 or 3 years.

Segmental resection is applicable to certain tumors; however, the long term results are often disappointing, with recurrence taking place within 5 years in the majority of cases.

Total cystectomy is a formidable undertaking and has a definite place as a method of dealing with selected cases, but it can never be a routine procedure for bladder cancer. Because of the frequency of death from metastasis even after total cystectomy, the author believes that this operation should be reserved for the relatively fit who are suffering from large sessile papillary growths or from multiple papillary tumors of which the bases have not infiltrated through the complete thickness of the bladder wall.

The author has used radiation therapy in selected cases, the most common being the solitary sessile broad-based papillary carcinomas occupying the base and lower zones of the lateral walls. Infiltrative growths of the flat ulcerative or nodular type similarly located have been the principal varieties chosen.

Technique of interstitial irradiation. Suprapubic exposure of the tumor is carried out and the projecting portion of the tumor is removed by the cutting current until it is flush with the bladder wall. The base is then cauterized. In the future, however, in deference to the opinion of the radiotherapist, cauterization of the base is going to be omitted so as to conserve the blood supply of the area. The system used for the distribution of the radium aims at homogeneous irradiation to the tumor-bearing area along with a zone of about 1 cm. peripheral to it. A dose of approximately 7,000 roentgens over a period of 160 hours is given in each case. The threads on the needles are brought out through the suprapubic wounds, where they are removed after the treatment period has passed. Drainage by means of a suprapubic tube is maintained for 2 or 3 weeks after removal of the radium.

Following treatment there may be some reaction to the radium. Vesical tenesmus may prove troublesome and necessitate sedative treatment. Frequency and terminal discomfort are generally experienced and may last several months. Early examination of the irradiated area revealed it to be covered by a grayish-white phosphaticlike incrustation. In the successful cases, the incrustations gradually diminish in size and finally melt away, leaving a smooth mucous membrane devoid of blood vessels and pale and lusterless compared with the surrounding mucosa. Up to a year may elapse before this stage is reached and in some instances 2 years have been required before all evidence of radium reaction has disappeared.

The author had irradiated 110 patients by the described method. Of these, 11 died as the result

of the operation, 10 died of intercurrent disease from 2 to 5 years after treatment, 52 died of bladder cancer, and 37 have survived 5 years or longer. Of the 37 who survived 5 years or longer, 1 died of a recurrence in the sixth year. Seven died of intercurrent diseases after 5 years, and 29 are alive and clinically free from 6 to 11 years after treatment.

The author believes that there is no single method of treatment applicable to all cases of cancer of the bladder and that in spite of whatever form of treatment is used there will be failures. The location, wide variation, and extent of bladder involvement, depth of penetration, differing histological gradings, and subsequent revelation of previously unsuspected metastases make comparison of different methods of treatment a matter of great difficulty. The author believes that papillary tumors which have an indurated base not greatly exceeding 5 cm. in diameter, and flat infiltrating growths of similar dimensions which are located in the lower zones of the bladder, overlying or near to the ureteric orifices, the trigone, or the urethral meatus are best treated by irradiation, and that better long term results are obtained from its use than from any other method of treatment.

E. W. Riches. The treatment and prognosis of bladder tumors depend most upon the pathological type of the growth and its situation in the bladder. Other factors which have an obvious bearing are the age and general condition of the patient, and the size and multiplicity of the lesions.

Bladder tumors show wide variations in their malignancy from the simple papilloma to the highly malignant ulcerative carcinoma. Intermediate between these lesions are the papilloma of uncertain malignancy and the papillary and nodular carcinomas.

The site of the tumor is a factor in determining the type of treatment to be used. Just as the therapeutic procedure cannot be determined by any one single factor, so it must not necessarily be limited to one particular method.

Cystodiathermy alone will often keep a growth in check when age or other conditions prevent more radical treatment.

The radiosensitivity of bladder tumors varies; x-ray therapy will often check bleeding, but the author does not believe that it alone will cure bladder cancer, nor will it make an inoperable tumor operable. The author has not used radium needles inside of the bladder for the past 10 years inasmuch as the cystitis produced was most severe. Radon seeds have been less painful and more successful. Both radium and radon have their limitations; if the growth is very large it is difficult to space the small needles or seeds accurately, and if the growth is already necrotic the existing cystitis will be intensified.

Partial cystectomy is the method the author has used in about 30 per cent of his cases, often combined with other forms of treatment. The percentage of 5 year survivals has been about 21 per cent. The excision must be wide and must include the full thickness of the bladder wall and the extravesical tissues. If the ureter is encroached upon it must be reimplanted into the bladder.

For accessible growths of moderate size situated in the mobile part of the bladder the author believes that partial cystectomy remains the method of choice. Total cystectomy is indicated when papillary tumors are widespread or when a nodular tumor is very large. It should not be reserved for the hopeless cases, which has been the tendency in the past and accounts in part for the poor survival rate. The best indications for the operation are multiple or extensive growths of the lower grades of malignancy, whether papillary or nodular.

There still remain many cases which from the extent and fixity of the growth fall into the almost untreatable group. Some of these will come safely through a ureteric transplantation, and such a palliative operation is worthy of consideration. It may be followed by x-ray therapy and will provide much better palliation than does a permanent suprapubic cystotomy, which often only adds to the patient's misery.

J. L. E. Millen. The author discusses two radiotherapeutic methods of treatment. One is the implantation of radon seeds and the other is deep x-ray therapy. He uses the results of his treatment during the period from 1932 to 1942 as the basis of his discussion.

Radon seed implantation is accomplished after suprapubic cystotomy and removal by diathermy of the intravesical portion of the tumor. The radon seed implantation is then carried out, the area of the implant being such that a margin of 1½ cm. width of the tumor is treated. The implant is of a single plane type. About two-thirds of the radon is used to form a strong peripheral ring, the remaining one-third being distributed evenly over the center of the area. After the implant has been completed a urethral catheter is inserted and the suprapubic opening is completely closed.

Radon seed implantation is the method of choice in the treatment of carcinoma of the bladder. It does have some limitations; first, in regard to area, a circle of 7 cm. is about the maximum area which it is practicable to implant inside of the bladder. The second limitation is in regard to thickness. Multiplane and volume implants are not practicable. A single plane implant can produce an effective dosage in a slab of tissue 1 cm. thick, i.e., ½ cm. on each side of the plane of the implant. Therefore, solid tumors infiltrating the bladder wall can be treated by implantation provided that after diathermy treatment their thickness is not greater than 1 cm. Radon seed implantation is applicable to the single lesion or small group of lesions which can be treated in one continuous area, but two, or more, distinct and widely separated growths can be treated if they are of reasonable size.

The authors treat all malignant growths coming within the limits described by radon seed implantation.

In radical x-ray therapy a multifield, beam-directed technique is used. The indications for radical deep x-ray therapy are not as clear-cut as those for radon seed implantations. In general, all tumors which are beyond the limits of radon seed implantation and not yet too advanced for hope of cure are given radical x-ray therapy. Radical treatment is contraindicated when there are distant metastases, or when the primary growth is so massive that it could not be covered by an 8 by 10 cm. field.

With a field size of 6 by 8 cm. a tumor dose of 6,000 roentgens can be given in 5 weeks. The dose is reduced to 5,500 roentgens when 8 by 10 cm. fields are used.

In summary, the author states that 80 per cent of the patients were given radical treatment. The majority of these were treated by radon seed implantation and by radical x-ray therapy—168 patients with a net 5 year survival of 28 per cent. The author is convinced that, both in the wide scope of their application and in the results obtained, these methods are superior to any purely surgical procedures. ROBERT C. BEADLES, M.D.

Total Cystectomy: A Consideration of the Technique. TERENCE MILLIN and F. MASINA. *Brit. J. Urol.*, 1949, 21: 108.

The object of this article is to present an operative technique of total cystectomy based on sound anatomicopathological principles. This technique has been evolved after a combined experience with a variety of methods in more than 100 cases. The indications for the operation of total cystectomy will vary from surgeon to surgeon. The 2 main indications for the procedure are papillomatosis and carcinoma of the bladder. Some patients in each group may be satisfactorily treated by less radical methods. The authors make a routine practice of securing portions of the tumor for biopsy and if any area histologically suggests a high grade type of malignancy, they seldom resort to cystectomy but prefer radiation therapy. Any evidence of fixation of the tumor after a careful bimanual examination precludes cystectomy, with hope of cure.

The majority of the total cystectomies were effected as a second stage procedure after a preliminary ureteral transplantation about 3 weeks previously. The authors usually do a bilateral transperitoneal ureterocolic anastomosis. In extremely poor risk cases the ureters are transplanted singly, but in good risk cases they have recently been doing a one stage operation, combining a bilateral transplantation and cystectomy at a single sitting.

In considering the operation of total cystectomy the authors believe that there is little difficulty in deciding the lower limit of removal of the urinary tract epithelium. In the male this should be distal to the verumontanum. In the female, they do not believe that the entire urethra should be routinely removed save in a lesion involving the base of the bladder, and in this type both the urethra and part of the neighboring vagina should always be removed. If the lesion is above the trigone, it is probably sufficient to extirpate the upper two-thirds of the urethra. The upper limit of removal is the entire stump of the ureter distal to the site of section for the ureterocolic anastomosis. When cystectomy is done as a second stage procedure it is sometimes quite difficult to accomplish this, and for this reason it is perhaps justifiable to effect a subtotal removal of the ureteric stumps if one is certain there is no lesion in the intramural or juxtavesical portion of the ureter. Although tumor involvement of the distal ureter is generally believed to be uncommon, it has occurred in some 10 per cent of the author's cases. The intermediate or regional lymph nodes are often ill-defined and frequently bipassed by the spreading carcinoma, but they are involved sufficiently frequently in clinically operable cases to warrant the authors' basing their operative technique on an adequate removal of the paravesical connective tissue along with the bladder.

The authors also believe that the operative technique should expose the obturator, internal, external, and common iliac lymph nodes to allow careful inspection and palpation with removal if it is deemed necessary.

The authors discuss the various routes of accomplishing total cystectomy and then describe in detail the preoperative preparation, the operative procedure, and the postoperative care of what they term the descending abdominal cystectomy, which they believe accomplishes the various points they think important in the cystectomy operation. They believe that there are two principles which should be accomplished: (1) to shun the bladder (to remain as far from the bladder as possible throughout the entire operation) and (2) to approach the midline last. This technique is accomplished by approaching the bladder from the side exposing the vascular supply, the vas, the superior vesicle pedicle, and the stump of the ureter. The lateral tip of the seminal vesicle is then exposed and its blood supply ligated. When both sides have been so treated the peritoneal surface of the bladder is exposed and severed. Following complete mobilization the plane between the prostate and the fascia covering the rectum is entered and this is dissected down to the apex of the prostate and the commencement of the urethra. After exposure has been obtained each lateral puboprostatic ligament is divided deliberately and the urethra is divided.

When bleeding in the retropubic region has been controlled by pack, the distant lymphatic drainage is examined, first on the side of the lesion and then on the opposite side, following which the operation is completed.

The operative technique is described in detail, and the original article should be referred to by those interested in the procedure. The author discusses the postoperative care and the possible complications that can occur.

Total cystectomy in the female is discussed in the light of anatomical differences in the female pelvis.

In dealing with carcinoma in the female (a lesion on the lower half of the posterior wall of the bladder clinically infiltrating or suspected of such), the authors remove the uterus, including the cervix and a strip of vagina along the posterior border of the urethra with the bladder. When the lesion involves the urethra they consider this an absolute indication for a vaginoabdominal operation. The perineal part is done last, and the entire terminal portion of the urethra is removed.

The authors reserve the operation of "vaginal cystectomy" for the poor risk type of case only, believing that it is pathologically unsound in that the lymphatic fields cannot be cleared.

This is an excellent article describing a method of total cystectomy and should be read by those interested in this procedure.

ROBERT C. BEADLES, M.D.

Missile Injuries of the Urethra. D. S. POOLE-WILSON. *Brit. J. Surg.*, 1949, 36: 364.

Fifty-three patients with injuries to the urethra were seen at a British Army Genitourinary Center and their cases are reported in detail. Two patients had double urethral wounds. The 55 lesions were distributed as follows: penile urethra, 14; bulbous urethra, 25; and posterior urethra, 16. The type of missile varied. Twenty-two patients had through-and-through wounds. The others had penetrating wounds.

Associated injuries to the testes, bony pelvis, and intestinal tract were common. Only 3 patients had perforation of the bladder.

Most patients had a suprapubic cystostomy in the forward echelon. Repairs at the Center consisted of prompt closure of granulating perineums, pedicle grafting to cover the denuded penis, and end-to-end anastomosis of completely severed urethras. Splinting urethral catheters were abandoned eventually, except in ruptures of the prostatomembranous segment when they were employed for at least 2 weeks. Sounds were used to maintain the continuity and patency of the anterior urethra. Incomplete ruptures in the penile and bulbous urethra were not sutured.

Penicillin irrigations were used in most of the wounds. Suprapubic catheters were removed when clamping resulted in voiding through the healed urethra. None of the suprapubic wounds required secondary closure.

Two patients died because of their associated injuries to other structures. Nine had to be evacuated before the cystostomy could be discontinued, but at least 4 of these were reported later as having normal micturition. Thirty-eight patients left the Center with normal urination. Four others had only minute fistulas.

Follow-ups were incomplete but there were no known instances of additional fistulas or severe strictures. Sexual disturbances in this series were fewer than had been anticipated.

ORMOND S. CULP, M.D.

GENITAL ORGANS

Carcinoma of the Prostate. OLE J. JENSEN, JR., and JAMES A. MOORE. *West. J. Surg.*, 1949, 57: 210.

The present study was an analysis of 80 cases of prostatic carcinoma. The symptoms manifested were essentially dependent on 2 conditions, urinary obstruction and metastatic involvement. Ninety-two per cent of the patients were treated for obstructions. Thirty per cent of the patients complained of pain in the back and lower extremities; lesser percentages had complaints referable to metastatic involvement.

On rectal examination 83 per cent of the patients manifested some induration, 50 per cent had hard, nodular glands, and 35 per cent hard, nodular, and fixed glands. In 15 per cent the prostate was not palpably suspicious.

Roentgen-ray studies proved to be positive in 52 per cent of the patients. Thirty-six per cent of the total group had metastasis in the pelvis, 26 per cent in the spine, 14 per cent in the femur, and 11 per cent in the ribs, with smaller percentages in the lungs, scapula, skull, and humerus.

The acid phosphatase level was found to be elevated in 31 per cent of the cases in which no metastasis was demonstrated. It was found to be elevated in 67 per cent of the cases in which there was positive roentgen-ray evidence of spread.

The diagnosis was established by a pathological examination in 71 per cent of the cases. Another 14 per cent revealed positive rectal findings plus metastasis to bone demonstrated by roentgen-rays. Eight per cent were first discovered or verified microscopically at autopsy. The remaining cases were diagnosed with less positive evidence.

From an analysis of their results the authors find there are 6 different types of cases, and the treatment employed will vary with the circumstance presented by each patient. They present the following outline for treatment.

Early carcinoma confined to the prostate. Perineal prostatectomy offers the only chance of cure, and patients in this classification should be good risks provided they are under 70 years of age.

Late carcinoma with absence of symptoms. There is obvious spread of the carcinoma beyond the capsule of the gland but no urinary obstruction or pain. The patients are probably best followed up closely without treatment until pain, obstruction, or weight loss occurs.

Late carcinoma with pain from metastasis. For the relief of pain, orchiectomy, the administration of stilbestrol, or both is the treatment of choice.

Late carcinoma with urinary obstruction. A transurethral resection is the procedure most commonly used. If pain is present with the obstruction, transurethral resection plus orchiectomy and/or the administration of stilbestrol is indicated.

5. Late carcinoma with loss of weight and general debility. In this group there is absence of pain or urinary obstruction, and orchiectomy is indicated. If

there is good response to orchiectomy, estrogens may be withheld until they are needed at a later date.

6. Late carcinoma with recurrence of pain and obstruction following orchiectomy. The authors are using x-ray irradiation locally to alleviate the pain and have been successful in approximately 50 per cent of the cases. ROBERT C. BEADLES, M.D.

New Horizons in the Surgical Management of Carcinoma of the Prostate Gland. ROBERT GUTIERREZ. *Am. J. Surg.*, 1949, 78: 147.

The author presents an optimistic preliminary report on new horizons in the treatment of primary carcinoma of the prostate, basing his views on the observation of 100 consecutive cases including 14 patients who were operated upon since the introduction of hormone therapy.

In the prehormone therapy era, only 10 per cent of the cases were suitable for radical perineal prostatectomy (the only method of cure) because of extension of the disease or technical inoperability. About half of these were salvageable. It is the author's opinion that with preliminary hormonal treatment and timing of the operation at a point of maximum retrogression of the tumor under hormonal influence, as many as 80 per cent of the patients presenting themselves with prostatic carcinoma may be rendered operable. Mention is made of previous reports by Colston and others in which inoperable cases were rendered operable in a similar manner.

Two types of prostatic carcinoma are recognized. Adenocarcinoma is a symmetrical enlargement of the gland, with a hard nodular irregular surface not unlike the knuckles of the hand. Despite extension beyond the capsule with involvement of the seminal vesicles, this type may be made amenable to surgery by the hormonal effect of transitory metamorphosis of the carcinoma and its metastases. Scirrhous carcinoma represents approximately 20 per cent of the cases. The gland is reduced in size, has a stony hardness, and is fixed and immovable. Bone metastases occur early. There is no response to hormone therapy since there is no glandular tissue left to respond. Treatment is purely palliative, via transurethral resection, to relieve urinary obstruction.

There are four stages of prostatic cancer, each with its special type of operative procedure. In type 1, the carcinoma is localized to the prostate. The gland and its capsule are totally removed, with subsequent plastic anastomosis of the membranous urethra to the vesical orifice. In type 2, the seminal vesicles also are involved and a complete prostatovesiculectomy is done. In type 3, there is added involvement of the bladder neck. This requires removal of the prostate, seminal vesicles, and bladder neck with the same type of anastomosis of the urethra to the remaining portion of the bladder. With involvement of the trigone, ureteral orifices, or lateral walls of the bladder, a type 4 procedure calls for transplantation of the ureters to the bowel, followed by an abdominoperineal prostatovesiculectomy and cystectomy.

In preparing the patient for operation, diethylstilbestrol is given three times daily for one month, in small doses of ½ grain. The next month the dose is increased to 1 grain three times daily. In about 2 months the changes required to render operation practicable will have taken place. In addition to tumor regression and frequent diminution of the metastases, there is relief from pain, diminished frequency of urination, and reduction of residual urine. During this period the patient is further prepared with urinary antiseptics, bowel regulation, antianemics, a strengthening diet, and indicated vitamins. There is a short period of hospitalization prior to operation for routine functional tests and drainage. Once the stage of optimum improvement has been reached, the surgical procedure to be followed in the individual case will be determined by the extent of the malignant growth and the involvement of the contiguous structures. The patient must, of course, meet the requirements of operability.

A description of the operative technique for radical perineal prostatectomy is presented. Urinary incontinence, the greatly feared complication of this operation, occurs very rarely following meticulous anastomosis of the membranous portion of the urethra to the bladder neck and reinforcement of the anastomosis by proper plication of Denonvilliers' fascia. This closes the prostatoperitoneal aponeurosis and prevents urinary leakage.

In the definitely inoperable adenocarcinomas and scirrhous carcinomas, relief may be further obtained, after exhaustion of the benefits of orchiectomy and the usual hormone doses, by administering massive doses of diethylstilbestrol, up to 305 mgm. daily. Another method which the author has used for palliation in these late cases is the administration of progesterone in daily doses of 25 mgm. by injection and 25 mgm. orally. When all palliative measures fail to relieve the symptoms and none of the radical perineal procedures seem justifiable, suprapubic cystostomy places the bladder at rest and the patient is more comfortable for his remaining life.

Fifteen case reports are detailed which illustrate the satisfactory results to date in patients operated upon after hormonal preparation and the effects of palliative care in those with inoperable lesions. No definite conclusions are permissible from this small series, but the clinical results have been most striking. ALLAN K. SWERSIE, M.D.

Retropubic Prostatectomy. FRANCIS A. BENEVENTI, and FRANCIS P. TWINEM. *J. Am. M. Ass.*, 1949, 140: 851.

The authors present an analysis stressing the highlights in a series of 40 successful retropubic prostatectomies. A large percentage of the patients were poor risks, but the smooth convalescence was striking.

The operative technique was basically that originally described by Millin, and the authors stress the necessity for careful handling and hemostasis of the vessels anterior to the prostatic capsule and those in

the vesical neck. Postoperatively the patients had a very uneventful recovery. Free drainage with periodic bladder irrigations was instituted after return from the operating room, and the patient was allowed out of bed on the second or third day. The catheter was removed on the fifth or sixth day.

There were few postoperative complications in this series. Several cases of very temporary stress incontinence responded immediately to simple muscular exercises. There was no permanent incontinence. One patient had a residual urine of 45 c.c. four months after operation. A running suture had been placed in the neck of the bladder. There were no cases of osteitis pubis, and although none of the patients had preliminary vasectomies, only 1 instance of epididymitis occurred. All of the patients who were potent before operation were likewise potent afterward. The endoscopic picture of the urethra demonstrated firm, smooth healing as early as 6 weeks postoperatively. The authors believe retropubic prostatectomy to be the operation of choice in selected cases of large benign hyperplasias of the prostate. JOSEPH E. MAURER, M.D.

Retropubic Prostatectomy. R. LICH, JR., O. GRANT, and J. E. MAURER. *J. Urol.*, Balt., 1949, 61: 930.

The authors have to date completed more than 500 retropubic prostatectomies and believe this method to be superior to any other in the treatment of the large adenoma or of the operable carcinoma of the prostate. A critical comparison has been made with perineal prostatectomy, and the results have been demonstrated to be comparable. This was to be expected, since both are methods of extravesical prostatectomy employing positive hemostasis and accurate approximation of tissue, and they vary only in their avenue of approach.

Surgically speaking, the significant anatomical facts to be considered in the retropubic prostatectomy of Millin are the fatty tissue in the retropubic area which is relatively avascular, the prostatic sheath which is highly vascular with large thin-walled veins scattered throughout its lamellae and more prominent anterolaterally, the puboprostatic ligament which is vascular and may be a source of troublesome hemorrhage in the radical operation, and the true prostatic capsule which lies surrounding the cleavage plane for enucleating the prostatic adenoma.

In performing conservative retropubic prostatectomy at the Norton Memorial Infirmary in Louisville, Kentucky, the authors utilize a short transverse incision through the skin and rectus fascia because of the better wound healing and absence of postoperative herniation. Early in this series the longitudinal incision was used. The rectus muscles are separated and the retropubic space is entered; a Millin retractor is placed in position. The veins lying on top of the prostate are ligated and divided and the capsule is incised transversely. The adenoma is enucleated after the urethra has been cut, and is trimmed free from the bladder neck. The prostatic arteries are ligated or fulgurated and after the bed has been rendered dry a catheter is introduced into the bladder per urethram. The capsule is closed with a running suture, and the wound sutured in layers, with a rubber tissue drain to the space of Retzius. The drain is removed on the third day and the catheter on the third or fourth day.

The same approach is used in performing radical retropubic prostatectomy. The puboprostatic ligament is ligated and divided and the prostatic capsule retracted cephalad. The exposed urethra is severed distal to the apex of the prostate. The gland is then swept free from the rectum and the prostatic arteries are visualized near the vesical neck and ligated. The seminal vesicles are dissected free and the vasa are stripped out, doubly ligated, and divided. The prostate with its attached vesicles and vasa are cut free from the neck of the bladder. Bleeding points are dealt with and the vesical neck is anastomosed to the cut stump of the urethra around a catheter. Catheter drainage is continued in these patients for 7 days.

In comparing the first 65 consecutive retropubic prostatectomies with the last 65 done perineally the average ages of the two groups of patients were almost identical, 68 years. Catheter drainage in the perineal group averaged 10.1 days as compared to 6.0 in the retropubic series. The postoperative hospital stay was 17.9 days in the perineal and 12.3 in the retropubic group. Blood transfusion was thought desirable in 66.1 per cent of the perineal series and in only 12.3 per cent of the retropubic group. In the perineal group there were 7 individuals who suffered temporary stress incontinence of less than 19 days' duration, and 1 person in whom it lasted almost 3 months. Three such instances were noted in the retropubic series, 2 of 5 days and 1 of 2 weeks' duration. Two instances of secondary hemorrhage were seen in the retropubic series, both of which were controlled by reinsertion of a catheter. One death occurred in the perineal series, and none in the retropubic group. It is the impression of the authors that the retention of potency is much greater in the retropubic series.

JOSEPH E. MAURER, M.D.

Testicular Pain: Its Significance and Localization. FRANCIS R. BROWN. *Lancet*, Lond., 1949, 1: 994.

This author discredits most of the older concepts regarding testicular pain, contends that local or scrotal pain originates in the tunica vaginalis rather than in the testis, and offers evidence that true testicular pain is felt only in the lower abdomen.

Pain caused by pinprick in transposed pedicled skin grafts was localized by the blindfolded patient in the original site of the skin and not in the new position. Similar observations were noted after orchidopexy, the testicular pain being confined to the lower abdomen. Pain within the scrotum (actually tunica vaginalis pain) was eliminated when the genital branch of the genitofemoral nerve was resected, but lower abdominal discomfort from testicular stimulation persisted.

Wyndham is quoted as having shown that the embryonic development of the testis occurs in the lower abdomen and not in the region of the adult kidney. This original or embryonic location of the testis is the site of true testicular pain even though the gonad has moved to the scrotum.

So-called "referred pain to the testis" is explained as merely stimulation of the genitofemoral nerve by the ureter which overlies the nerve. Such discomfort was produced experimentally by irritating this nerve. This type of discomfort actually is in the tunica vaginalis instead of the testis.

Similar explanations regarding ovarian pain are offered, as well as a review of current theories and popular speculations concerning pain.

ORMOND S. CULP, M.D.

MISCELLANEOUS

Diagnosis of Urogenital Tuberculosis. E. M. MEDLAR, D. M. SPAIN, and R. W. HOLLIDAY. *J. Urol.*, Balt., 1949, 61: 1078.

There is general agreement that tuberculosis of the kidney is a metastatic, blood-borne infection, but there is no similar agreement relative to tuberculous infection of the organs of the genital system, especially with reference to the relationship of the infection in one organ to that in the other organs of this system. The literature on genitourinary tuberculosis deals primarily with the clinical problem of diagnosis and treatment, but relatively little emphasis has been placed on the pathogenesis of tuberculosis as a whole in relation to the disease in the genitourinary organs. A divergence of opinion exists with regard to the relationship between renal and genital disease and between the different organs of the genital system. In order to evaluate the postmortem findings compared with the clinical diagnosis of genitourinary tuberculosis in adult males, the authors reviewed 5,424 autopsies performed on males over 16 years of age at the Bellevue Hospital, New York, during the 10 year period from 1935 through 1944. These findings were analyzed with reference to age, race, death from tuberculosis, unhealed tuberculosis in those dead from other causes, the relationship between pulmonary, renal, and genital tuberculosis, and a comparison of the autopsy with the clinical diagnosis of genitourinary tuberculosis.

The pathogenesis of tuberculosis is difficult to demonstrate clearly because the initial focus of infection in any organ is of microscopic size and because these tiny foci always progress slowly. Tuberculous lesions measuring from 1 to 2 mm. in diameter are frequently observed at autopsy and, in most instances, it has taken 2 weeks or longer to attain such dimensions. Lesions of this size would probably cause no clinical symptoms. It is essential that this slow progress be considered in any study of an individual with genitourinary tuberculosis.

Tuberculous infection is one in which various organs of the body may become involved through blood-borne metastases and, on occasion, the extent of disease may become greater in the metastatic than in the original focus. The first symptoms of a tuberculous infection may be referred to an extrapulmonary organ and a thorough clinical study may fail to reveal the initial or "primary" lesion located in the lung.

It is the authors' opinion that those individuals in whom genitourinary tuberculosis develops represent a group that, as a whole, has an impaired resistance to tuberculous infection in general, and in such a group it is not surprising that the infection terminates in a generalized disease.

It is probable, although absolute proof is not possible, that a small tuberculous renal lesion may ulcerate, discharge its contents into the urine, and later heal completely, but the prostate may become infected at the time the urine is contaminated. This phenomenon could account for the finding at autopsy of tuberculosis in the prostate with a macroscopically normal kidney. It is fallacious to assume that renal lesions never existed when tuberculous lesions are found only in the genital organs, for the data presented in this article show that renal lesions were twice as frequent as lesions in the prostate and three times as frequent as those occurring in other genital organs.

In the authors' series of cases they found 6 patients who died from tuberculosis with involvement of both the prostate and seminal vesicles. The data presented would indicate that whenever epididymal lesions are of macroscopic proportions, more than one—and frequently all—of the genital organs are tuberculous. The authors' observations favored the opinion that "on the ground of anatomical evidence a simple castration cannot be a satisfactory answer to the treatment of genital tuberculosis."

In this series of cases only one-half of the patients with a tuberculous renal cavity presented urinary symptoms; whereas 40 per cent of those with necrotic but unexcavated renal lesions also had manifest urinary symptoms. This observation would indicate that the presence and the status of renal tuberculosis is often not reflected accurately by the genitourinary symptoms.

The clinical management of a patient with genitourinary tuberculosis should be based upon a clear concept of the pathogenesis of tuberculosis as a whole. If the intention is to prevent a further spread of the disease by surgical removal of the organ in which tuberculosis is recognized, the data presented in this article would indicate that other organs have already been affected and the surgical procedure is too late to obtain the desired results. A major premise for nephrectomy in an individual with renal tuberculosis is the protection of the opposite kidney; however, autopsy data show that an "autonephrectomy," a process that takes place over a long period of time, may occur and the other kidney remain free from macroscopic evidence of tuberculosis. The occurrence of generalized miliary tuberculosis after nephrectomy led to the assumption that the operation

was responsible for this occurrence. This may be true, for the autopsy data show that the prostate, the most common source of generalized miliary tuberculosis in the genitourinary system, is tuberculous in a high proportion of individuals with excavating renal tuberculosis. However, there are lesions in other organs that are equally effective sources for the origin of generalized miliary tuberculosis, and the individuals in whom urogenital tuberculosis occurs are prone to develop a generalized disease even when surgery is not done.

In résumé, the authors made the following statistical deductions from their study of 5,424 autopsies:

Tuberculous lesions in the genitourinary system were present in 3.1 per cent of all autopsies, in 4.5 per cent of the persons harboring unhealed tuberculous lesions who died from causes other than tuberculosis, and in 26 per cent of persons dead from tuberculosis.

Caseous or cavitating pulmonary tuberculous lesions were present in 85 per cent of the individuals with genitourinary lesions.

Forty-five per cent of the patients presenting tuberculous lesions in the genitourinary organs died from generalized miliary tuberculosis, with or without tuberculous meningitis.

Lesions in the kidney were twice as frequent as in the prostate gland and three times as frequent as in the seminal vesicle or epididymis.

The incidence of genitourinary tuberculosis was greater in males under 40 years of age, although in total numbers the males over 40 outranked those under 40 years of age.

Sixty-five per cent of the renal lesions were miliary in type with 98 per cent of them bilateral; in this group of patients 13 per cent showed lesions in the genital system.

Twenty-three per cent of the renal lesions were caseous in type, with 86 per cent of them bilateral; in this group of patients 52 per cent revealed lesions in the genital system.

Twelve per cent of the renal lesions were cavitating in type with bilateral location in 58 per cent; in this group genital lesions were present in every case.

Eleven per cent of the patients had no renal lesions while the prostate gland was involved in every case and other genital organs were involved in one-half of the cases.

In tuberculosis of the genital system, the prostate gland, seminal vesicle, and epididymis were involved in 63 per cent of the cases, the prostate alone was involved in 29 per cent, and the seminal vesicle or epididymis was involved alone in no case.

Bilateral involvement of the seminal vesicle was found in 81 per cent, and of the epididymis in 64 per cent, of patients with genital tuberculosis.

Urinary symptoms were absent in one-half of the patients with a tuberculous cavity in the kidney.

Although tuberculous disease was recognized clinically in 80 per cent of the patients with tuberculous lesions, the clinical recognition of the disease in the genitourinary organs occurred in only 18 per cent. This indicates the difficulty encountered in recognizing tuberculous disease in the genitourinary system. Advanced disease may be present without significant urological symptoms.

CONRAD A. KUEHN, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Experimental Investigations into the Etiology of Calve-Perthes' Disease. AA. RANDLEV-MADSEN. *Acta orthop. scand.*, 1949, 19: 6.

By injecting alcohol around the vessels and nerves running to the femoral head in young rabbits, macroscopic, roentgenographic, and histological changes similar to those of Calve-Perthes' disease were produced. Various injection and staining methods were attempted to demonstrate the integrity of the circulation. Injection of red-lead-gelatin showed the course of the arteries, and confirmed that the main artery ran under the neck; other methods were also used. India ink-gelatin gave good pictures of the arrangement of the vessels. No new formation of vessels was seen in the head, but there was rich proliferation of the vessels around the site of the alcohol injections. When the vessels were artificially distended by the injection these methods gave no true impression of the degree of filling of the blood vessels.

It is suggested that Calve-Perthes' disease is produced by a disturbance of the natural growth of bone tissue due to an action on the factors which determine the differentiation of the cells and the structure and shape of the tissue so that a more primitive form of growth predominates. The process is thought to be initiated by a number of causes, among which the constitutional, hormonal, and traumatic are emphasized.

The author concluded, as a result of his experiments, that the disorder consists of a disturbance of the natural growth of the bone. There is interference with the factors that determine the normal differentiation of the cells and the structure and shape of the tissue.

C. FRED GOERINGER, M.D.

Osteoarticular Tuberculosis and Streptomycin (Tubercolosi osteo-articolare e streptomicina). FRANCO FAGGIANA. *Policlinico, sez. chir.*, 1949, 2: 45.

Observations on 8 cases of tuberculous osteoarthritis led the author to the conclusion that streptomycin is an extremely valuable addition to our therapeutic armamentarium, although it should be considered only an adjuvant while immobilization remains the basis of proper treatment.

Of the two forms of osteoarthritis, namely, the destructive with caseation, and the productive, the latter is more amenable to streptomycin therapy. Four effects of the antibiotic may be distinguished: (1) rapid disappearance of fever and local turgor, (2) speedy recalcification, (3) considerable acceleration of the recovery, and (4) good functional results.

The author usually prescribes 0.2 gm. of streptomycin parenterally three times a day, supplementing this medication with a local application of from 0.2 to 0.5 gm. of the same drug. When the total dose of parenterally administered streptomycin has reached 20.0 gm., only local applications are continued.

Untoward effects of the drug on the nervous or urinary excretory system have never been noticed, but 1 patient showed signs of allergy.

The results of the treatment with streptomycin were poor in the exudative types of tuberculous osteoarthritis, such as psoas abscess.

JOSEPH K. NARAT, M.D.

On the Tendency of Ewing's Sarcoma to Heal Spontaneously, and on the Alterations Due to Irradiation. LARS UNANDER-SCHARIN. *Acta orthop. scand.*, 1949, 18: 436.

Although Ewing's sarcoma was described in 1921, it seems obvious that neither its histogenesis nor its treatment is clearly understood. For instance, the author states that Stewart-Harrison (1934) reports a case of Ewing's sarcoma of the tibia in which nuclear pyknosis with chromatin and abnormal staining qualities occurred 12 hours after a single dose of irradiation. Other early biopsy changes with or without minimum irradiation are: (1) cyst formation, (2) hemorrhage within tumor, and (3) necrosis with variable degrees of fibrosis and bone formation. On the other hand, Brunschwig (1936) described 3 cases of Ewing's sarcoma which were unaffected by irradiation.

Kolodny, Phemister, Swensson, and others report a limited number of proved cases of Ewing's sarcoma which were cured by variable doses of irradiation therapy. The modus operandi, well postulated by Ewing, may be summarized as a melting down process of the blood vessel endothelium with interstitial hemorrhage or insidious, progressive, obliterative endarteritis with failure of nutrition to the neoplasm and massive necrosis under irradiation bombardment.

Occasional enlargement of a tumor with intermittent fever is based upon intraneoplastic hemorrhage and its inevitable absorption.

The author presents detailed case reports of 16 cases of Ewing's sarcoma treated by irradiation, and 17 untreated by irradiation. In the majority of cases, histological studies were obtained. Twelve of the 16 patients received some form of surgical treatment in addition to postoperative irradiation. Statistically, 12 patients lived a total of 80 months, or an average of 6.5 months per patient. Two patients lived 4 and 7 years, respectively, and all finally died of metastases, except 2 patients who are still alive after 3 and 5 years, respectively.

That spontaneous regressive changes of variable duration occur in Ewing's sarcoma is attested to when one observes the following changes in the untreated cases: (1) regressive changes in tumor cells with necrosis, (2) reactive processes consisting of cellular infiltration and the formation of connective

tissue and bone, and (3) hemorrhage and thromboses. Moreover, in the author's third case, that of a girl aged 7, the patient developed a limp in 1931 and sustained a fracture of her femur (upper end) 1 year later. The x-rays did not reveal any evidence of Ewing's sarcoma at this time. One year later, she was readmitted for a pathological refracture. A plum-sized cyst was found in the cortex. A bone graft was performed and promptly healed. Histological examination of the tissues disclosed the possibility of a Ewing's sarcoma. Nine years later, the patient began to show unequivocal signs of the sarcoma and finally died of metastases 9 years after the apparent spontaneous regression of the neoplasm.

There were 17 patients treated by irradiation. The findings were as follows: (1) 7 of the 17 patients underwent surgical treatment in addition to irradiation therapy; (2) 8 patients survived a total of 26 months, or 3.2 months per patient; (3) 5 patients survived 2, 3, 3.5, 4.5, and 8.5 years, respectively; and (4) 3 patients are alive at 4, 10, and 10 years, respectively. Peculiarly enough, patients not receiving the benefit of irradiation showed spontaneous degeneration and destruction of the tumor cells with necrosis and hemorrhage.

The author maintains that the periosteum offers resistance to progression of the tumor by hyperplasia and connective tissue proliferation about the new growth. Hemorrhage with ensuing necrosis governs the fluctuating size, temperature, and rate of malignancy in Ewing's sarcoma. The morbidity, curability, and radiosensitivity depend on the nutritional status of the tumor. SAMUEL L. GOVERNALE, M.D.

Calcium Deposits in the Vicinity of the Shoulder and of Other Joints. J. ALBERT KEY. *Ann. Surg.*, 1949, 129: 737.

The incidence, etiology, pathology, symptoms and clinical course, roentgen findings, treatment, and prognosis of calcium deposits near the shoulder and other joints are described in detail in this article along with photomicrographs and roentgenograms. It is believed that the usual simple method of treatment for these calcium deposits, such as heat, massage, needling, and x-ray treatment is of little value. The author believes that when there is a definite calcium deposit with painful symptoms, the deposit should be removed surgically, and he reports good results from this method of treatment. Nine patients operated on have been relieved of pain promptly and the condition has not recurred.

RICHARD J. BENNETT, JR., M. D.

Hyperlordosis and Hypolordosis of the Lumbar Vertebral Column (Hyper- und Hypolordose der Lendenwirbelsaeule). OSKAR A. STRACKER. *Zschr. Orthop.*, 1949, 78: 265.

Hyperlordosis or hypolordosis of the lumbar spine is one of the most frequent causes of backache. Hyperlordosis is more common in men, hypolordosis in women. As it is impossible to alter the degree of spinal curvature directly by belts or other orthopedic appliances, correction should be attempted by changing the angle of the pelvic axis.

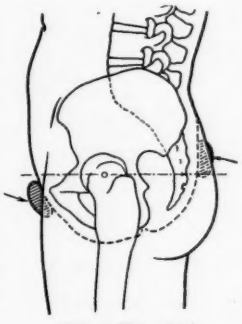

Fig. 1 (Stracker)

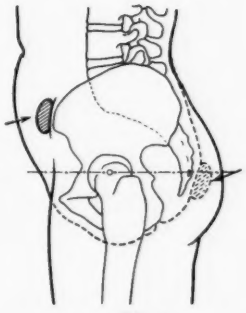

Fig. 2

The pelvis can be considered as an immovable unit for all practical purposes although the author could show by experiments with heavy weights that, under extraordinary circumstances, minute movements in the sacroiliac junction are possible. The only way to correct a hyperlordosis or hypolordosis is, therefore, to tilt the pelvis forward or backward, as the case may be.

Two different kinds of belts have been constructed for correction of these anomalies. In hypolordosis pressure is exerted by pads on the symphysis anteriorly and on the upper portion of the sacrum posteriorly. In hyperlordosis the pressure acts on the iliac spines anteriorly and on the lower portion of the sacrum posteriorly. The action of the pads is strengthened by springs.

In appropriate cases the backache disappeared immediately after application of the supports. Some patients were able to discard the belts after 2 or 3 months; others had to wear them permanently to avoid recurrence of the backache.

WERNER M. SOLMITZ, M.D.

Pathologic Torsion of the Femur and Coxa Valga. Its Surgical Correction by Oblique Intertrochanteric Osteotomy (Die pathologische Femurtorsion und Coxa valga. Ihre operative Beseitigung durch intertrochantere Schraegosteotomie). RUPPRECHT BERNBECK. *Zschr. Orthop.*, 1949, 78: 303.

The author describes a new kind of operation for the correction of the typical deformities of the proximal femur end in congenital luxation. These deformities are always combined. They are functional external rotation (antetorsion), coxa valga, and the impairment of extension.

An oblique extra-articular osteotomy is done between the trochanters, and proximally to the insertion of the psoas muscle. No wedge of bone is removed.

The trochanters are exposed after incision of the fascia lata. Two screws are inserted in the femur, one distally to the minor trochanter, the other in the direction of the femur neck. Then the osteotomy

is performed in an angle that has been computed from the roentgenogram. The distal fragment is rotated until the desired angle and the correction of antetorsion has been reached, and the bone is fixed in this position with the help of the screws. The patient is put in a cast for 6 weeks; the screws are removed 4 weeks after the operation.

The author has performed this operation in 21 cases with satisfactory early results. A definite evaluation, especially as to the development of the femur head and the acetabulum will be possible only after a number of years.

WERNER M. SOLMITZ, M.D.

Lunatomalacia. FREDERIK THERKELSEN and KJELD ANDERSEN. *Acta chir. scand.*, 1949, 97: 503.

The authors have made an extensive study of lunatomalacia, or Kienbock's disease. An interesting pathogenic contemplation is presented. Of the various causes enumerated, pathologic compression fracture resulting from bone necrosis of obscure origin is the most important. Repeated trauma, invoked by the carpal scaphoid, is equally significant in the precipitation of lunatomalacia. Among the authors' 109 cases, 42 patients had an unquestionable history of trauma. Twenty-six of the patients were females. In 31 cases the condition involved the right hand.

Some of the roentgen findings were: (1) change in shape; (2) the presence of areas of translucency and increased density; (3) flattening of the entire bone was a constant sequela.

The earliest x-ray findings are said to be a faint increase in density of the bone, plus the decrease in height of the bone. Later, a compression fracture may be delineated. The latter, of course, is a more advanced evidence of malacia.

Healing, for the most part, is best in children; the earliest signs of healing have been observed within the first 3 years after injury. In some patients, healing has required as long as 10 years. In 12 of 33 cases of lunatomalacia, the condition became worse after from 9 to 11 years; i.e., areas of rarefaction, fragments, and flattening increased.

Osteoarthritis of the wrist occurred in 23 of 61 cases in the series. Twenty-two of these patients were subjected to excision of the semilunar bone. Of these, 5 attained ideal functional restoration; the results in 9 cases were rated as good, and in 8 cases, as poor.

With regard to the prognosis and treatment of lunatomalacia, the authors state that the prognosis is favorable among juvenile patients and among the zero variants. In their follow-up of 92 of the 109 cases, functional restoration was assessed as ideal in 21, good in 40, and poor in 31 patients. The period of observation of the 92 patients averaged 6.6 years.

Immobilization in plaster of paris for more than 2 months does not enhance the ultimate functional or roentgenological restoration of the wrist. Early immobilization does not mitigate or modify the morbidity of the semilunar fractures. Excision of the semilunar (an excellent form of treatment) is not as innocuous as one is led to believe. According to the authors, most of the poor results emanate from surgical extirpation of the bone. Moreover, from the authors' point of view, it is permissible to assume that the nature of trauma rather than the form of therapy influences the end results. A treatment that is excellent in one case may prove disastrous in another. Hence, no panaceal regime can be determined or recommended as a result of the present investigation.

SAMUEL L. GOVERNALE, M.D.

Athletes' Hernia of the Tibialis Anticus Muscles. MICHAEL C. OLDFIELD. *Brit. J. Surg.*, 1949, 36: 405.

Multiple small, often symmetrical, hernias of the tibialis anticus muscles occur fairly frequently in athletes but are rarely recognized. They are usually mistaken for simple varices. These hernias occur through well defined oval defects in the sheath, which are most likely congenital. The exciting factor is persistent strenuous exercise.

The symptoms consist of an aching pain or a heavy or tight feeling in the legs after exertion or toward the end of the day. Small swellings appear on the front of the legs. Occasionally these are erroneously injected as varicose veins. The swellings are more pronounced in the fencer's lunge position with the hip, knee, and ankle flexed. They disappear on passive plantar flexion of the foot, or on active dorsiflexion of the foot and toes. On palpation the tumors are soft, easily reduced, and at their base a defect in the tibialis anticus muscle sheath can be felt.

The conservative treatment consists of crepe bandages when walking and the avoidance of strenuous exertion. The operative treatment consists of repair of the small defects with fine strong silk or linen, interrupted mattress sutures. The larger defects require fascia lata patch grafts. After surgery the patient requires 2 weeks of bed rest and support with a crepe bandage for the next 4 weeks. Strenuous exertion must be avoided for from 3 to 6 months. Five case reports are presented.

DANIEL H. LEVINTHAL, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Observations of the Treatment of Pseudarthroses and Bone Defects of the Long Bones (Considérations sur le traitement des pseudarthroses et des pertes de substance des os longs). A. TALBOT. *Rev. orthop.*, Par., 1949, 35: 151.

The author presents a series of 50 cases, in 24 of which the upper extremities, and in 46 of which the lower extremities were involved.

The best time for intervention in simple fractures is as soon as possible; in case of infection the author recommends a waiting period of 6 months after drainage has ceased. In 1 case the operation was performed 1 month after drainage had stopped and was followed by penicillin therapy. The result was satisfactory.

The approach should be made through a noninfected area. In cases of a posterior sinus the anterior

approach should be used. In every instance the tissue through which the incision is made should be very carefully appraised.

Spinal anesthesia was used in cases of involvement of the lower extremities, except in children.

Internal fixation following the Kuentscher method was done whenever possible. In cases of bone defect the internal fixation was supplemented by a bone graft.

The author discusses the advantages and disadvantages of onlay and inlay grafts, and states that it did not make any difference as to the ultimate result. He also stated that it is irrelevant whether or not the periosteum is left on the bone graft.

The author makes a comparison between the results obtained in these conditions after the first World War and those obtained after the second World War. He stated that the results were better after the second World War and attributed the better results to the discovery and use of penicillin.

GEORGE I. REISS, M.D.

Surgical Approaches to the Shoulder Joint. LEROY C. ABBOTT, JOHN B. DEC. M. SAUNDERS, HELEN HAGEY, and ELLIS W. JONES, JR. *J. Bone Surg.*, 1949, 31-A: 235.

The shoulder joint is a complex mechanism consisting of the sternoclavicular, the acromioclavicular, and the scapulohumeral joints, together with the virtual joint between the scapula and the thoracic cage. Elevation of the arm is accomplished by movement occurring simultaneously in the several joints, and operations upon any of them must be planned with minimum interference with their gliding surfaces and with the ligaments and muscles which support and control their movements. The surgeon must consider the functional and dynamic aspects of the shoulder complex and possess an accurate anatomical knowledge to enable him to carry out the contemplated procedure with the least possible disturbance of function. Although these joints operate as a unit, the surgical approaches to each one should be considered separately. The authors describe in detail the surgical anatomy, indications for operative treatment, the position of the patient, and the type of incision.

Two features of the sternoclavicular joint are of special importance: (1) the integrity of the joint is dependent in greatest measure upon the accessory ligaments, notably the costoclavicular, and (2) the relations of the joint, especially the intimacy of the great veins of the neck to the posterior aspect and the close relationship of the pleura, must be borne in mind. Indications for approaching the joint are recurrent and disabling dislocation, infection requiring drainage, and tumors involving the joint. The position of the patient is supine, with a small sandbag placed between the shoulder blades. A straight or curved incision is made through the skin, exposing the capsule of the joint and the two heads of the sternocleidomastoid muscle. The joint surfaces are then exposed by curved division of the capsule and by subperiosteal reflection of the heads of the sternocleidomastoid. When tumors involve this joint, more extensive dissection may be required, with ligation of the anterior and external jugular veins.

Dislocation of the acromioclavicular joint cannot occur without damage in greater or less degree to the coracoclavicular ligament, surgical repair of which is often necessary when the dislocation is complete. In reconstructing the coracoclavicular ligament by fascia lata or other material, the new ligament should be attached to the clavicle well posteriorly at the apex of the lateral curve or along the trapezoid line. Indications for approaching the acromioclavicular joint are dislocations, fractures involving the joint, infections, and arthritis. The patient is placed in a sitting position with the shoulder extending well beyond the edge of the table and with the arm at the side. For repair of the coracoclavicular ligament, an extensive exposure is generally required, such as is described by Roberts. Repair may be accomplished by any one of a variety of techniques, such as those employed by Bunnell, Bankart, or Lowman.

Complete exposure of the anterior, superior, lateral, and posterior aspects of the scapulohumeral joint can be secured by a curvilinear skin incision which follows the anterior margin of the deltoid and its line of origin from the clavicle, acromion, and spine of the scapula. This permits the origin of the deltoid to be reflected subperiosteally from the clavicle, the inferior margin of the spine of the scapula, and the superior surface of the acromion process. The remainder of the deltoid attachment to the acromion is freed by osteotomy of its lateral border. This method of detaching the deltoid, with an edging of periosteum and bone, provides for adequate repair with sound healing. A segment of the curvilinear incision may be utilized for exposure of one or more aspects of the scapulohumeral joint; therefore, this incision might appropriately be termed the "comprehensive" incision for exposure of the scapulohumeral joint.

The sitting position is used in practically all operations on the scapulohumeral joint. It is particularly successful in removal of calcified deposits in the musculotendinous cuff, in rupture of the supraspinatus, recurrent dislocation of the shoulder, and fractures of the head and neck of the humerus and its tuberosities.

In approaching the anterior aspect of the scapulohumeral joint, a deltopectoral incision is indicated for fractures and dislocations of the shoulder, and tenosynovitis and dislocation of the long head of the biceps. The position of the patient is supine with the arm at the side or supported in varying degrees of abduction by an arm board. Landmarks to be observed are the outer one-third of the clavicle, the acromion, the coracoid process, and the deltopectoral groove.

The shoulder-strap incision of Henry is indicated in tumors of the anterior aspect of the joint, fractures involving the joint, arthrodesis of the joint, recurrent

dislocation of the shoulder, and tenosynovitis or dislocation of the tendon of the long head of the biceps. The patient is preferably in the sitting position. The landmarks are the same as those for the deltopectoral incision.

Longitudinal separation of the fibers of the deltoid is recommended for calcified deposits in the musculotendinous cuff, rupture of the supraspinatus, and fracture of the tuberosities of the humerus. The patient is in a sitting position with arm free at the side and shoulder over the margin of the back rest with the elbow held at a right angle and the forearm supinated. The landmarks are the acromioclavicular joint, acromion, humerus, and bicipital groove. Local anesthesia is preferable.

Several approaches to the superolateral aspect of the shoulder joint are described. Longitudinal splitting of the deltoid fibers with partial separation of the deltoid from the margin of the acromion is indicated for removal of calcified deposits which lie posteriorly, and for the repair of complete rupture of the supraspinatus. Transverse division of the deltoid is indicated for arthrodesis of the shoulder joint. Separation of the deltoid from its origin on the clavicle and acromion is similar to Henry's shoulder-strap incision and may be used for fractures, arthrodesis of the shoulder joint, and repair of the musculotendinous cuff. In osteotomy of the acromion process, the transacromial approach of Darrach and McLaughlin is considered preferable to the Codman approach because the former preserves the acromioclavicular joint. Indications for osteotomy are repair of the musculotendinous cuff, recurrent dislocation of the shoulder, fixation of the tendon of the long head of the biceps in the bicipital groove, and repair of fractures in the region of the greater and lesser trochanters.

Approach to the posterior aspect of the joint is indicated for posterior dislocation of the head of the humerus, certain fractures of the head of the humerus and the posterior portion of the glenoid, excision of the shoulder joint, and tumors of the neck of the scapula. The approaches as described by Kocher, Harmon, Rowe and Ye, and Bennett may be used.

Approaches to the inferior aspect of the shoulder joint may be achieved by the method of Thomas. Other approaches to the axilla, usually for purposes of drainage of the axillary space, are made along the inferior margin of the pectoralis major.

RUDOLPH S. REICH, M.D.

A Case of Bilateral Traumatic Dislocation of the Hips (Un caso di lussazione traumatica bilaterale dell' anca). M. CORNACCHIA. *Chir. org. movim.*, 1949, 33: 32.

The author reports a case of bilateral traumatic dislocation of the hips. On one side there was an associated fracture of the acetabular rim, while on the other there was complete paralysis of the sciatic nerve.

The patient was a woman 35 years of age who had jumped from a third story window during a depressive state of mind and had sustained the dislocation of the hips.

Roentgenograms revealed a sciatic dislocation on her right side while her left side showed a fracture of the acetabular rim with an iliac dislocation of the hip.

The hips were reduced without difficulty under anesthesia with the knee bent to a right angle and traction on the hips. After 16 months the function of the sciatic nerve completely returned. Both hips regained full range of motion.

The author was able to find a total of 55 cases described in the literature, including his own. Eighty-nine per cent occurred in males and 11 per cent in females. In only 2 of the cases was there an associated sciatic nerve lesion.

CARLO SCUDERI, M.D.

Hemipelvectomy for Malignant Tumors of the Bony Pelvis and Upper Part of the Thigh. ROBERT A. WISE. *Arch. Surg.*, 1949, 58: 867.

Hemipelvectomy is the operative procedure in which the entire lower extremity with the adjacent innominate bone is removed through the sacroiliac and pubic joints. It offers the best method for eradication of primary radioresistant malignant tumors of the ilium, ischium, and pubis, or similar tumors of the upper thigh. Only 138 hemipelvectomies had been reported in the literature to 1946, with a high operative mortality. Pack reported 6 operations without mortality. The author and his colleagues report 5 without mortality.

The technique described by Pringle and standardized by Pack is described. To this is added the temporary control of the common iliac artery. The incision is made from the symphysis pubis and follows the inguinal ligament to the anterior superior spine of the ilium. It continues along the crest of the ilium and then directly downward just posterior to the greater trochanter, across the gluteal fold around the medial aspect, and then anteriorly to the point of origin. The attachments of the rectus abdominis muscle and the inguinal ligament to the pubis and iliac spine are divided. The inferior epigastric vessels are ligated and divided, and the spermatic cord is retracted. The peritoneum and bladder are retracted medially to expose the iliac fossa. The common iliac, external iliac, and hypogastric arteries are exposed, and a controlling tape is placed around the common iliac artery. The external iliac artery and vein are transfixed, doubly ligated, and divided. The muscles attached to the crest of the ilium are now divided. The symphysis pubis is separated with an osteotome. The psoas muscle is divided as high as possible, the femoral nerve sectioned, and the sacroiliac joint exposed and divided. It is usually possible to divide the superior gluteal and obturator vessels and nerves during the anterior dissection. The patient is then turned on the uninvolved side, and the posterior skin flap is developed back to the sacrum. The gluteus maximus muscle attachment to the sacrum is divided and the muscle sectioned. The

sciatic nerve, piriformis, and levator ani muscles are cut across. Division of the sacrotuberous, sacrospinous, and sacroiliac ligaments completes the removal of the extremity. The controlling tape of the common iliac artery is removed and the skin flaps are approximated with through-and-through interrupted silk sutures.

A helpful prosthetic device has been constructed at the Portland Veterans Hospital. This prosthesis supports the abdominal wall and is padded to replace the absent buttock, which permits comfort in sitting. DANIEL H. LEVINTHAL, M.D.

Synovectomy in Cases of Chronic Arthritis and Tuberculosis of the Knee, with Discussion (La synovectomie dans le traitement des arthrites chroniques et de la tuberculose du genou). ROBERT KAUFMAN. *Mém. Acad. chir.*, Par., 1949, 17, 18: 427.

The author bases his report on 26 cases of chronic arthritis and tuberculosis of the knee, of which 15 occurred prior to 1948. All results were highly satisfactory. The patients were children between the ages of 9 and 16 years. The author stated that tuberculosis usually stays in the soft parts around the joints for a considerable length of time and later invades the bone very slowly. Four incisions are made, two anteriorly and two posteriorly. Hemostasis is accomplished with the cautery. In 2 patients an excision of the inguinal lymph nodes was done in addition to the synovectomy of the knee. Although the adenosynovial theory of tuberculosis may not hold, the results prove its validity. There were no complications, no pulmonary lesions, and no meningitis. An additional 7 cases of tuberculosis were proved by history and guinea pig inoculation.

There were few complications in this series. They consisted of supracondylar fractures in 4 cases. In 11 cases a true ankylosis of the knee joint occurred; 1 patient had very little flexion, but 6 had a range of knee flexion up to 90 degrees and 2 had completely normal flexion.

SORREL: "White tumors" in children follow a very benign course. Kaufmann, in his report, is trying to make a very complicated situation out of a very simple uncomplicated condition.

MOULONGUET disagrees with Kaufmann because the latter ignores completely the well known facts pertaining to the pathology of tuberculosis.

ANDRA RICHARD disagrees with Kaufmann because the operation is too dangerous. He had 2 cases which did not do well at all. He stated that in his cases a fistula developed and in 1 case the leg had to be amputated. GEORGE I. REISS, M.D.

FRACTURES AND DISLOCATIONS

An Evaluation of Intramedullary Nailing of the Long Bones (Ueberblick ueber das Verfahren der Marknagelung). GERHARD KUENTSCHER. *Aerzt. Wschr.*, 1949, 4: 289.

The intramedullary nail has to be driven firmly into the long bone to insure close contact of the

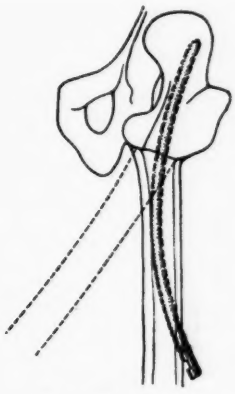

Fig. 1 (Kuentscher).

fracture fragments. The advantages of intramedullary nailing are the complete lack of complications even in old people and the shortening of hospitalization. The average time was cut down from 120 days to 40 days of hospitalization in fractures of the femur. The nail damages the marrow, but experiments have clearly shown that the callus formation is not influenced by it. The bone marrow regenerates very quickly because it is not a very highly differentiated tissue. The blood picture shows eosinophilia in patients younger than 40 years. The eosinophilia disappears after the removal of the nail. There were no other blood changes noted.

The use of intramedullary nailing is also recommended in cases of infected fractures. There were no complications necessitating amputation of the limb, and the mortality was zero. The same procedure is also recommended in pseudarthroses of the upper and lower extremities. It has also been used in osteotomies and in shortening procedures of the long bones. The nail was also used in osteotomies done for congenital dislocation of the hips. No cast was necessary. Ambulation was possible within 2 or 3 weeks. Intramedullary nailing is also used for arthrodesis of the joints, especially of the knee joint. It was also used for immobilization of fractures of the long bones due to bone tumors, especially in the subtrochanteric region. The disadvantage of this method is that good surgical judgment and skill are necessary. Surgical shock is likely to be increased by a prolonged operation.

GEORGE I. REISS, M.D.

On the Subject of Recurrent Dislocation of the Shoulder. MARIO BELGRANO and RENATO GAMBIER. *Acta orthop. scand.*, 1949, 18: 319.

The authors stress particularly the merits of the Delitala operation, which combines the utmost technical simplicity with the notable advantage that the glenoid labrum is attached to the scapula extra-articularly. Delitala, like Bankart, was able to con-

firm many times the detachment of the glenoid labrum from the rim of the glenoid, and he therefore attributed the recurrent dislocation to the presence of this lesion.

In 1930 Delitala first sutured the detached labrum to the rim of the glenoid by means of silk sutures passed through holes made in the glenoid edge. He encountered many technical difficulties and therefore, in 1931, abandoned the idea of suturing; instead, he fixed the glenoid labrum to the scapula by means of two small stainless steel nails.

The essential points are as follows: through a skin incision, 8 cm. long, running from the coracoid process down between the deltoid and pectoralis major, the tip of the coracoid process is isolated and excised with a sharp osteotome and is pulled downwards; the humerus is externally rotated and the tendon of the subscapularis is carefully detached. By dissection, 2 cm. away from the long head of the biceps, the capsule is exposed and incised longitudinally; the glenoid surface, the labrum, and the capsule are carefully explored. Then, one or two small T-shaped nails are driven through the outer surface of the glenoid, firmly fixing the capsule and labrum to the bony edge which has first been roughened with a gouge. The hole in the capsule is sutured; the tendon of the subscapularis and the tip of the coracoid process are reattached, and the soft tissues are sutured. The wound is dressed and immobilized, preferably with a plaster cast in medium abduction, for a period of one month.

In a recent work, Delitala has claimed permanent good results with the use of this method on 30 patients with habitual dislocation of the shoulder; a number of these patients have been examined many years after operation. The good condition found at these examinations would indicate that the real cause of the recurrence consists in detachment of the capsule.

In summary, the authors state that the cause of recurrence in almost all cases is detachment of the glenoid labrum from the scapular rim. In exceptional cases it is possible for a tear of the capsule to occur at the point where it is contiguous to the labrum itself; such a tear is not susceptible to spontaneous cicatrization, because of its particular anatomical structure. The traumatic lesion that determines the lesion responsible for habitual dislocation of the shoulder may be different from that indicated by Bankart. Further, when lacerations of the capsule are found, the glenoid labrum should always be carefully inspected. Attachment of the glenoid labrum to the glenoid by means of small stainless steel nails (performed by Delitala since 1931) is the operation that is preferred—because of its quick and simple technique and the slight trauma it involves.

C. Fred Goeringer, M.D.

Recurrent Dislocation of the Shoulder Joint. Ake Jakobsson. *Acta orthop. scand.*, 1949, 18: 284.

Perthes (1906) seems to have been the first to describe the detachment of the glenoid labrum from the anterior margin of the glenoid. He considered this lesion as a causative factor of redislocation in some cases of recurrent shoulder dislocation. In other cases he attributed the recurrence to a rupture of the supraspinatus tendon. Anglo-Saxon authors (Bankart, Watson-Jones, et al) are of the opinion that the avulsed glenoid labrum constitutes the predisposing factor, and point to the fact that such a detachment may follow injuries characteristically sustained in certain sports, such as Rugby. The author came to the following conclusions:

The changes in the shoulder joint which may cause dislocation or subluxation in normal movements are as follows:

1. Avulsion of the glenohumeral ligaments from the anterior glenoid margin which, in the majority of cases, appears at operation as a detachment of the glenoid labrum; thereby the anterior support disappears, which prevents the head of the humerus from sliding forwards on outward rotation, and on extension.

2. Posterior defect in the humeral head which makes it possible for the head to be caught on the anterior glenoid rim. If this condition is fulfilled, an intracapsular subluxation may arise.

3. Rupture of the capsule according to Hybbinette's description in more advanced stages of recurrent dislocation.

The best operations (it appears, from a comparison of the material published) are plastic procedures in the region of the anterior glenoid margin with bone grafting according to Eden-Hybbinette, and reposition of the glenoid labrum in conformity with Bankart.

The reported incidence of redislocation after the Eden-Hybbinette operation in 200 cases was 1.5 per cent.

Palmer has recently made a study of 60 cases with 4 recurrences; however, in contradistinction to other authors, he took into account recurrences in cases in which there was redislocation following renewed injury.

Operation, according to the Bankart technique, was performed in 134 cases, and there were 3 recurrences.

The Nicola operation seems to be the one most often employed, but in a total of 187 cases there were 42 recurrences (22%).

Follow-up examinations were made on 42 patients, and 43 shoulder joints were operated upon according to the Eden-Hybbinette method with the following findings: (1) no recurrence; (2) bone grafts were found to have solidly fused in 35 of 36 cases with roentgenographic control; (3) it is recommended to insert the bone graft level with the glenoid rim, not overlapping it. By this measure one is likely to avoid arthrosis deformans.

4. It appears that the bone graft should probably not be designed to build out the glenoid margin. It is wiser to regard the graft as a method of connecting the capsule and ligaments to the glenoid margin.

C. Fred Goeringer, M.D.

Habitual Posterior Dislocation of the Shoulder Joint. AMNON FRIED. *Acta orthop. scand.*, 1949, 18: 329.

The action of the muscles which rotate the arm is discussed. It is possible that posterior dislocation is due to lack of co-ordination of their action; but it is not clear how normal co-ordination is disturbed by trauma or congenital predisposition, though both of these undoubtedly play some part in producing the condition. Few authors have given an exact description of the actual dislocation. It always occurs when the arm is rotated medially and brought to a position between flexion and abduction, below the horizontal plane. The head glides out of the glenoid fossa, and its posterior surface can be felt on the back of the joint. As the arm is rotated laterally, the head snaps back into its proper position. Complete dislocation never occurs without severe trauma. Roentgenograms of the shoulder usually show no bone change, and, in fact, the dislocation itself can be easily overlooked on routine roentgenography unless tangential views are taken. Usually the joints dislocate when the arm is in medium abduction and anteflexion, and at the same time internally rotated. It is recommended that axial roentgenographs be taken to confirm the diagnosis.

Twenty-one habitual and recurrent shoulder dislocations were seen at the Orthopedic Clinic of the Karolinska Institute in the years from 1946 to 1947. Three of these were posterior dislocations. It is thought that similar cases may often be overlooked, as special care is required for a correct diagnosis.

Five cases are reported, in 1 of which the condition was bilateral. All patients were treated by a bone block operation (modified Eden-Hybbinette type) on the posterior surface of the joint; 6 joints were so treated. In one case the graft was absorbed and dislocation recurred after a period of 12 months. An iliac crest bone graft is inserted into a periosteal pocket outside the joint on the posterior surface of the scapula, the lateral part of the graft overlapping the capsule for about 1 cm. The graft is held in position by sutures, vitallium screws, or nails. In 4 cases the joint capsule was opened and the cavity explored for diagnosis. Mobilization of the joint was begun 3 to 8 weeks after operation.

C. FRED GOERINGER, M.D.

Aspiration of the Elbow Joint in the Treatment of Fractures of the Head of the Radius. T. B. QUIGLEY. *N. England J. M.*, 1949, 240: 915.

The author states that in recent years there has been a revival of the principle of early motion in the treatment of elbow fractures, especially fractures of the radial head. Comminuted fractures, or severely displaced fragments of the radial head are treated by excision, but in cases of only moderate displacement, or impaction with minimal displacement, minimal immobilization is indicated. Active motion, while good treatment, may be difficult to obtain because of pain, and it is in this situation that aspiration is beneficial because it is usually followed by relief of pain and marked increase in the range of motion of the elbow.

Aspiration of the elbow joint should not be carried out until 24 hours after the injury, for the hemarthrosis might recur. Strict asepsis should be practiced. The technique is as follows: with the forearm pronated to minimize the possibility of injury to the deep branch of the radial nerve, and after infiltration with procaine, a 16 gauge needle is introduced into the joint through the center of the triangle formed by the head of the radius, the tip of the olecranon, and the lateral epicondyle of the humerus. More than 10 c.c. of thick, bloody fluid under pressure is often encountered. When this fails to provide satisfactory relief of pain and improvement in motion, excision is indicated, and this decision can almost always be made at the time of aspiration.

NEWTON C. MEAD, M.D.

Trochanteric Fractures of the Femur. E. MERVYN EVANS. *J. Bone Surg.*, 1949, 31–B: 190.

The author deviates from the usual classification of trochanteric fractures and divides them into stable (72%) and unstable (28%). The importance of the cortical buttress of bone on the medial aspect of the femoral neck and shaft is stressed.

Three series of cases are presented: 101 patients treated conservatively in the hospital, 25 sent home because of lack of hospital beds, and 22 treated with the Capener-Neufeld nail-plate. From a review of these cases the author concludes that routine operative treatment of trochanteric fractures has the advantages of greater comfort and mobility, lower mortality, and economy of hospital beds. Only a small proportion of patients can be allowed early weight-bearing, but almost all can be up in a chair and most of them can be taught to use crutches without weight-bearing within a few days after surgery.

DANIEL H. LEVINTHAL, M.D.

Trochanteric Fractures of the Femur. R. C. MURRAY and J. F. M. FREW. *J. Bone Surg.*, 1949, 31–B: 204

A series of 100 consecutive cases of trochanteric fractures of the femur treated conservatively during the period from 1941 to 1947 are reviewed.

With few exceptions these fractures were treated by traction with adhesive. Skeletal traction was employed in only 6 cases. In the early cases in this series a Braun, Thomas, or Hodgen's splint was used with an internal rotation bandage, but in the more recent cases splints were discarded, the limb being placed in a pillow with from 12 to 18 pounds of traction over a pulley at the foot of the bed and an internal rotation bandage attached to an overhead pulley with 3 or 4 pounds of weight being applied just above the knee. Counter traction is provided by raising the foot of the bed. The patient uses a pillow or backrest. Movement of the normal extremities is encouraged. Internal fixation was reserved for those exceptional cases in which traction was found to be inadequate. The mortality rate was 10 per cent. DANIEL H. LEVINTHAL, M.D.

Fractures of the Tibial Spines. CHARLES H. BRADFORD, RONALD W. ADAMS, and H. KELVIN MAGILL. *N. England J. M.*, 1949, 241: 137.

The foundation of knowledge of fracture pathology was established before the days of roentgenography by keen observers who studied the defect at autopsy and reconstructed the mechanism of injury. Thus, Poncet in 1875 in Paris, France, described the "tearing off of the spine of the tibia by the anterior cruciate ligament." Dittel reported a similar case a year later from Germany.

This fracture is properly that of the tibial eminence just anterior to the spine where the cruciate inserts. It occurs most commonly in the young or adolescent. Generally it is elevated upward and backward in its anterior portion and only slightly displaced posteriorly. The anterior cruciate functions to resist backward displacement of the femur on the tibia, or vice versa, and it also checks excessive inward rotation of the tibia on the femur. Undue stress in these directions may cause an avulsion fracture at the tibial attachment of the ligament.

Reference is made to Blaisdell's report of 1922 describing the three possible injuries from this force, namely: avulsion of the tibial eminence, rupture of the ligament, or avulsion of the attachment to its point of origin on the inner side of the lateral femoral condyle. Fracture without avulsion of the anterior spine has been reported as being caused by the lateral femoral condyle smashing into it, especially if the collateral ligaments are unstable and the tibial spines are unduly long.

Diagnosis of fracture of the anterior cruciate ligament is made by history of injury, swelling of the knee, and hemarthrosis, with pain and inability to extend the knee. X-rays may be diagnostic, yet a small osteochondral fragment with slight calcification may be overlooked.

Treatment by the closed method when there is minimal or no displacement requires only a cylinder cast for from 5 to 7 weeks with full weight bearing. In more severe avulsions, manipulation under anesthesia into a position of full extension may reduce the fracture, or a preliminary rotation of the tibia on the femur prior to extension may be of aid. The use of direct pressure alongside the patellar tendon to depress the fragment is mentioned.

The open method of treatment is recommended by Roth because he has found the lateral meniscus to interfere with reduction. On the other hand, Clarke was able to reduce all 10 fractures of his series by the closed method. MacAusland and Lee favor open reduction and immobilization for only 3 weeks. Sever favors closed treatment. The authors favor the medial parapatellar incision and oblique drilling from a point below the plateau and to the side of the tibial tubercle up into the fracture defect. Another such hole is made parallel to the first and the fragment is mattressed into place with a No. 2 chromic suture. A cylinder plaster is worn for a period of 3 weeks, after which gradual knee motion is permitted.

Five case reports are offered in which 4 patients were treated by the closed method with good results. A fifth patient was operated upon for a torn cartilage and the fractured spine was repaired.

DANIEL H. LEVINTHAL, M.D.

ORTHOPEDICS IN GENERAL

Notes on the Histochemical Aspect of the Changes of the Spinal Motor Cells in Anoxia, Vitamin E Deficiency, and Poliomyelitis. LÁRUS EINARSON. *Acta orthop. scand.*, 1949, 19: 55.

The state of chromophilia, chromoneutrality, and chromophobia gives a fairly accurate measure of the nucleic acid content of the anterior horn cell. This content is altered in anoxia, vitamin E deficiency, and after poliomyelitis to produce swelling and chromophobia of the nerve cells accompanied by hyperexcitability and spastic rigidity of the muscles. The nucleic acid derivatives are essential for the metabolism of the neuron and responsible for the formation of acetylcholine. The presence of adenosine triple phosphate is required for the consumption and resynthesis of acetylcholine, the first constantly reformed by liberation of adenylic acid from the polynucleotides of the cytoplasm (Nissl substance). Since in vitamin E deficiency oxygen consumption of the tissues is enormously increased, vitamin E must either have some control over the tissue respiration or diminish the oxygen consumption. In vitamin E deficiency the structural defect of chromophilia is explained by the fact that highly increased oxygen consumption leads to exhaustion of the cell energy reserve with sublethal anoxia and accumulation of polynucleotides and arrested resynthesis of acetylcholine. Vitamin E is an instrumental factor in the liberation of adenylic acid from the polynucleotides of the nerve cells.

As to poliomyelitis with typical changes in the anterior horn cells the author cites 3 possibilities: secondary sublethal anoxia, defective liberation of vitamin E (dysvitaminosis), and primary injury of the spinal internuncial neurons and reflex pathways. He recommends large doses of vitamin E (from 30 to 60 mgm. of tocopherol for 1 or 2 years) as part of the after treatment of poliomyelitis. From his experimental work he also suggests this medication as a prophylactic measure against poliomyelitis in combination with vitamin B (inositol) together with doses of hog stomach and duodenum (ventriculin-pylorin), also recommended for spinal atrophy and muscular dystrophy.

The nerve cells in the central part of the anterior horns are most vulnerable to the poliovirus and therefore they are attacked first. This is explained by Krogh, in the anatomical findings: the central cells lie close to the venous ends of the capillaries while the cells of the periphery are in the main close to the arterial ends of the capillaries. By the very slow circulation produced by occlusion the peripheral cells use up most of the oxygen and thus have greater resistance.

E. H. BETTMANN, M.D.

On the Internal Structure of the Motor Cells of the Anterior Horns and Its Changes in Poliomyelitis. LÁRUS EINARSON. *Acta orthop. scand.*, 1949, 19: 27.

An extremely important structural element of nerve cells is the so-called Nissl substance, which appears in the cytoplasm as strongly basophil, coarse or fine, fragments or granular particles.

The author indicates that he is able to identify at least three different compounds, nucleoproteins (chromatin substance), and acid and basic proteins, respectively. The structural changes of the nerve cells have been studied by the aid of the progressive, selective staining with gallocyaninchromalum, which allows a quantitative estimation of the basophilia of the cells. Since the stain becomes selectively bound to the nucleic acids of the structures, its intensity (chromophilia, chromoneutrality, chromophobia) gives a fairly accurate expression of the cellular content of the nucleic acids, which varies markedly in poliomyelitis as well as under experimental conditions (anoxia, vitamin E deficiency). Extreme chromophobia may be produced by prolonged irritation or by experimental insulin shock; in human brains and spinal cords it also occurs in various diseases and toxic conditions, and it may reach such a degree as to resemble closely the most intense phase of chromatolysis.

On the basis of numerous investigations it must now be considered established that the cellular changes are primarily due to a direct, selective action of the virus on the nerve cells, and that this is the real causative factor of the actual poliomyelitic paralysis. The previously prevailing conception that the degeneration of the nerve cells was a secondary consequence of the inflammatory process must be abandoned.

In poliomyelitis the acute changes of the cells (swelling, chromatolysis, vacuolar dissolution, neuronophagia) are distinguished from the chronic or late changes (extreme chromophilia, cell sclerosis, lipodystrophy, and irreparable cell atrophy), and both are estimated in relation to the varying cellular content of nucleic acids. Lasting pareses and muscular atrophies may be due to these chronic cellular changes, and need not necessarily be due to an acute loss of the cells.

Several observations support the view that the motor cells may remain for a long time in the torpid but still reversible state of extreme chromophilia, without any noteworthy damage to the trophic control of the axon. The good results of the physiotherapeutic after treatment of poliomyelitis (the systematic training of paretic and atrophic muscles), often achieved in orthopedic hospitals, are thought to be due in no slight degree to a release of the motor cells from their torpid state of extreme chromophilia, followed by a gradual recovery of their impulse activity.

In this article are included several illustrations of the cellular structure in instances of poliomyelitis.

C. FRED GOERINGER, M.D.

Experimental Tendon Repair Within the Flexor Tunnels: Use of Polyethylene Tubes for Improvement of Functional Results in the Dog. RICHARD I. GONZALEZ. *Surgery*, 1949, 26: 181.

Analyzing the poor results obtained in the repair of the flexor tendons severed in the proximal two-thirds of the fingers or the distal inch of the palm, called the "No mans land of tendon repair" by Bunnell, the author investigated the pathology by creating through elaborate experimental studies analogous conditions in 30 mongrel dogs. The reason for the minimal function return is the breaking down of the gliding mechanism formed by the common synovial sheath of the flexors profundus and sublimis enclosed in a snug fitting fibrous tunnel in the region overlying the proximal phalanx. In the majority of cases immobile adhesions result. In order to block the formation of adhesions Gonzalez used polythene tubes (derivative of paraffin) as suitable membranes because of the inertness, flexibility, and adaptability.

Tendons blocked away from the extratendinous tissues by polythene tubes following primary suture within the flexor tunnels and immobilized for 40 days or longer approach normal function, while control tendons showed nonfunction. Such a long immobilization carried out on 25 animals ensured a clear differentiation of tendon from extratendinous tissue as compared with control tendons immobilized for a shorter period which resulted in a solid mass of scar tissue. As a promising procedure, based on the results with 5 animals, the author suggests the use of polythene wrapping around tendons that have healed primarily but are bound down by adhesions.

In the carefully conducted experiments comprising more than 190 tendon operations, a tension wire was woven through the flexor digitorum profundus with a pull out loop through the common portion of the tendons according to Bunnell's suture at a distance. A primary tendon suture (right angle basket weave suture) on two or one of the slips relaxed distally can be made under exactly similar conditions with one tendon for experiment and one for control. The operative steps were: insertion of tension wire with proximal pull-out loop excision of the sublimis tendon after the osseous fibrous tunnel was split free. Tests for strength and function were performed at varying intervals by placing the dissected tendon segments in a tensiometer. The data suggest that function is greatly improved following primary suture in the flexor tunnels if the suture line is blocked away from the extra tendon tissues by means of a polythene tube. Details about the elaborate measurements and the operative technique have to be read in the original. E. H. BETTMANN, M.D.

Painful Amputation Stumps and Phantom Limbs. W. RITCHIE RUSSELL. *Brit. Med. J.*, 1949, 1: 1024.

Current surgical practice concerned with amputations involves measures which are designed to protect the stump neuromas from trauma or irrita-

tion. At the operation the nerves are often divided as short as possible, and most modern prostheses aim at avoiding pressure on the nerves. In spite of these precautions pain in the amputation stump, or phantom limb, remains common (Sliossberg, 1948) and is often associated with spasmodic twitchings of the stump. The latter may become so violent that the term "epilepsy of the stump" is sometimes used; Weir Mitchell (1872) employed the term "chorea" to describe them.

The medical treatment of these patients has been disappointing and the difficulties encountered in getting relief by surgical measures is evident from the current neurosurgical practice of treating some of them by excising areas of the brain.

The following case records, however, indicate that treatment at the periphery may, after all, prove successful by a very simple procedure. This possibility was considered for three chief reasons: (1) in the normal limb nerve endings in the skin are rendered insensitive by occupations which involve repeated minor trauma or prolonged firm pressure on the skin; (2) conduction of a mixed nerve is easily interrupted by repeated pressure, without the production of any spontaneous pain; (3) the regenerating nerve fibers in an amputation stump are likely to be no less vulnerable to minor trauma or pressure than are normal nerves and nerve endings. It seemed obvious, therefore, that the effect of maintaining tender neuromas in a chronically concussed state merited investigation. Seven case reports are presented.

The first method tried was to deaden the neuromas with procaine and to percuss them for from 10 to 15 minutes with a piece of wood.

In 1937 a man aged 25 lost portions of 4 fingers of the left hand in a machine accident. He made a good recovery, and remained fit for work as a carpenter until February, 1942, when the palm of the left hand began to sweat excessively. One year later, while serving in the South African Army, he began to experience sharp stabbing pains in the phantom fingers and dorsum of the hand. On February 28, 1944, the stellate ganglion was excised. The pain was relieved for 2 weeks, but then returned with great severity.

On examination in Cairo, 4 weeks after operation, Horner's syndrome was present on the left hand and the hand did not sweat. The ends of the amputation stumps were very tender, especially over some palpable neuromas. There was no sensory loss. On April 2 the digital nerves of the index finger stump were injected with procaine, and then for about 15 minutes the end of the stump was hammered quite vigorously with a light piece of wood (a wooden test-tube container). This treatment was very successful, and the other tender stumps and scars were similarly treated. Thereafter it was found that if the patient tapped the tips of the amputation stump on a table for several minutes at a time two or three times daily, or if he applied prolonged pressure by handling tools firmly, he could keep all spontaneous pain and stump tenderness in abeyance.

RICHARD J. BENNETT JR., M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Varicose Veins. R. STANTON SHERMAN. *Ann Surg.*, 1949, 130: 218.

The commonly accepted procedure of high saphenous vein ligation, with or without retrograde injection, leaves much to be desired, although it is of considerable benefit to some patients with varicosities. It is believed by the author that a much more radical surgical approach is necessary in order to obtain ideal results. "I do not agree with the opinion that incomplete filling of veins in 30 or more seconds as observed in the Trendelenburg 'positive' tests indicates the absence of incompetent perforator veins in the leg or thigh. Indeed about 95 per cent of the surgically treated extremities were Trendelenburg 'positive' and in 823 out of 901 lower extremities obvious pathologic perforator veins were found."

The failure of high ligation to prevent recurrences of varicosities entirely is believed to be due to incompetent perforators below the saphenofemoral junction. During multiple tourniquet tests, the fact that the filling of veins occurred much less rapidly when the tourniquet was placed below the knee than when placed at the groin resulted in the assumption that most of the deficiency was due to incompetencies in the thigh. The failure of multiple tourniquet tests to locate the incompetent thigh perforators led to further anatomic and surgical studies. These explorations revealed that incompetencies in the thigh are relatively rare and therefore could not be responsible for the inadequate results so frequently observed. Similar studies on the leg revealed incompetent perforator veins to be very common and often of huge size. The number of incompetent perforators in a single extremity varied from one to fourteen.

In the course of this work, dissections were carried out on 63 cadavers and observations were made on 482 patients involving 901 lower extremities. A detailed description of the pattern of the perforator veins in the lower extremity is presented. Three principal findings resulted from the anatomic dissections:

1. The main long saphenous vein in the leg and foot courses distally adjacent to the medial border of the tibia and is situated deep to a distinct fascial layer that is continuous with the deep fascia of the thigh.

2. The lower part of the short saphenous vein, although superficial to the traditional deep fascia of the leg, is also deep to the fascia which is a continuation of the deep fascia of the leg.

3. The perforator veins of the leg and foot are numerous and, in general, fit into a rather easily established pattern.

The author's surgical procedure based upon this information has improved the results of therapy. It consists of a combination of injection of veins, high ligation, elimination of the main saphenous stem, eradication of the midhunter canal perforator venous plexus, and excision of all incompetent perforators in the leg or foot. The judicious use of a sclerosing solution as an agent to control hemorrhage is very helpful in controlling bleeding at the time of operation. The operative time for one extremity is about 3 hours. Usually both lower extremities are treated simultaneously.

In the entire group so treated, no deaths or massive hematomas occurred. There were 23 mild infections and 3 rather severe infections. Seven mild embolisms occurred. Spinal or general anesthesia was used.

As a result of these studies, the author is convinced "that the efficacy of any treatment of varicose veins is in direct proportion to the ability of the operator to eradicate incompetent perforator veins wherever they are located." ROBERT A. NABATOFF, M.D.

"Effort" Thrombosis of the Axillary and Subclavian Veins: An Analysis of 16 Personal Cases and 56 Cases Collected from the Literature. LE ROY J. KLEINSASSER. *Arch. Surg.*, 1949, 59: 258.

"Effort" thrombosis of the axillary and subclavian veins occurs predominantly in males, in the active age group, and most commonly involves the right side. The inciting incident may merely be unaccustomed activity, pitching a baseball, or lifting heavy objects. Prolonged ordinary activity involving the arms and shoulder girdle, strenuous physical activity involving the same structures, abduction of the arm, compression of the shoulder girdle, and sudden violent backward motion of the shoulder girdle are additional factors. Swelling and pain are the most frequent beginning symptoms. The swelling is usually gradual and unnoticed at first, whereas the pain is sharp and severe as an initial symptom and is followed by swelling and cyanosis in from one half to several hours. The swelling usually disappears by the tenth day. The introductory pain is usually in the shoulder and axilla and rarely along the course of the vein. In contradistinction to thrombosis in the lower extremities, in which the distal portion of the extremity tends to swell initially, the most pronounced swelling is in the proximal portion, although the entire extremity may be involved. The initial symptoms must be due to spasm and obstruction. As soon as the spasm subsides and the collateral circulation becomes active, the edema will gradually decrease.

The most prominent signs are edema, prominence of the superficial veins, cyanosis, palpable venous cord, fullness over the anterior region of the chest and shoulders, and rubrocyanosis. The blood pressure may be elevated on the involved side, the venous pressure increased, the circulation time re-

tarded, the oxygen saturation of blood decreased, and the temperature of the skin lowered.

Stellate sympathetic ganglion block seems to be the most direct attack on the vasospasm. Elevation controls the edema in the early stages, and compression does this in the late stages. Foci of infection should be eliminated and a search made for the primary causes of venous stasis and the increased coagulability of the blood.

Despite energetic treatment, the late results proved disappointing, with residual effects in over 75 per cent of the reviewed cases. This emphasizes the need for early adequate treatment with regional sympathetic ganglion block and elevation of the extremity, followed by compression bandages and gradual resumption of activity within the limitations of the recurrence of symptoms, particularly edema, which, if allowed to persist, will certainly result in permanent incapacitation.

ROBERT A. NABATOFF, M.D.

The Management of Recovery from Venous Thrombosis in the Lower Limbs. JOHN HOMANS. *Surgery*, 1949, 26: 8.

This article is an analysis of the late results of spontaneous bland venous thrombosis (phlebothrombosis) in 55 patients treated by various methods. The methods included treatment by (1) physiotherapy alone, (2) interruption of the superficial femoral vein (distal to the profunda), (3) common femoral vein interruption, (4) common iliac vein interruption, and (5) anticoagulant therapy.

The author concludes that of these five methods, ligation of the common femoral or iliac veins gives the highest incidence of untoward postphlebitic sequelae and the seriousness of these sequelae is proportional to the extent of the thrombosis. Superficial vein ligation with anticoagulants gives uniformly good results, the anticoagulants being necessary to prevent subsequent embolism, and anticoagulants alone are satisfactory. In the management of all cases the consistent use of gravity drainage, graded exercises, bandaging, and the proper balance between dependency and elevation will influence the course and sequelae. Ultimate recovery after an extensive thrombosis depends on these factors.

JOHN H. KAY, M.D.

The Early Results of Sympathectomy in Far-Advanced Arteriosclerotic Peripheral Vascular Disease. FREDERICK A. COLLER, KENNETH N. CAMPBELL, BRADLEY M. HARRIS, and ROBERT E. L. BERRY. *Surgery*, 1949, 26: 30.

This report concerns 63 patients who were subjected to lumbar sympathectomy for far-advanced obliterative arteriosclerotic vascular disease and were followed up for a 2.5 year period. Those considered suitable for operation demonstrated: (1) some response to sympathetic block, either subjective symptomatic relief or temperature rise in the involved extremity, (2) evidence of arrest or improvement of the process on a period of conservative therapy, and (3) lack of widespread arterial involvement with slowly progressive changes. Contraindications to sympathectomy are considered to be: (1) severe cerebral, cardiac, or renal involvement, (2) paradoxical response to lumbar block, (3) a rapidly progressive process with widespread arterial involvement, (4) far-advanced atrophy of the involved extremity with skeletization, and (5) constant intractable pain. Pain, symptomatic cold feet, intermittent claudication, ulceration, and gangrene were the presenting symptoms. Seventy per cent of these patients received some measure of alleviation of their symptoms following operation, but 17.5 per cent underwent eventual amputation, obtaining no help from sympathectomy. Of those with pain, 47.5 per cent were completely relieved; of 45 with cold feet, 71 per cent obtained symptomatic relief; of those with intermittent claudication 87 per cent obtained some measure of improvement although no patient was able to walk an unlimited distance after the operation. Ischemic ulcerations healed or improved satisfactorily in 57.5 per cent of the patients with this condition. Seventy per cent of those with gangrene had no further loss of substance following operation.

The authors describe the complications encountered in detail, many of which were peculiar to sympathectomy in arteriosclerotic vascular insufficiency.

It would appear from the reported series and the comparable results of other workers that sympathectomy in this type of arteriosclerotic peripheral disease offers a definite hope and produces a significant salvage rate.

EDWARD H. CAMP, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

The Value of Homografts. FREDERICK J. MCCOY. *Plastic & Reconstr. Surg.*, 1949, 4: 389.

Tissue transplanted from one individual to another of the same species is a homograft. The only authentic reports of permanent survival of transplanted homologous skin have been in cases of monozygotic twins. However, in severely burned patients losing ground from excessive fluid loss, pain, and debility in spite of adequate supportive measures they may prove to be an excellent emergency "dressing" to gain time for ultimate autografting.

The author believes that with modern supportive measures it is only a very rare case in which this procedure is indicated. Homografts take as well as autografts but survive for only 3 to 10 weeks. Donors may be selected at random without regard for blood grouping, race, or sex. Skin from a given donor will not take a second time because of the development of a specific antibody response. Severe reactions may occur at rare intervals when host sensitivity to donor proteins exists.

A case is presented in which homografting proved a life-saving measure. F. J. LESEMANN JR., M.D.

On Thromboembolic Diagnosis in Practice and on the Need of Anticoagulant Prophylaxis. M. SULAMAA and AURA PENTTI. *Acta chir. scand.*, 1949, 98: 130.

This article represents an analysis of the clinical experience of the Finnish Red Cross Hospital in thromboembolic disease. The aim of the analysis was to determine if this condition could be diagnosed sufficiently early and accurately to rely on anticoagulant therapy, or whether, because of the inability to make early and accurate diagnosis, prophylactic therapy should be used.

In this series of 22,000 cases 170 cases of thromboembolic disease were encountered, an incidence of 0.8 per cent. Twenty of the 170 patients died, an over-all mortality of 0.1 per cent. Very significantly, 14 of the 20 deaths occurred in cases undiagnosed as thromboembolic disease during life. Thus the mortality from thromboembolic disease occurred mainly in cases that remained undiagnosed during life. The death rate in the recognized cases was only 3.8 per cent. Thus, the authors conclude that the diagnosis of this disease cannot be made with sufficient accuracy so that one can rely on specific treatment, and that if further reduction in the death rate is to be achieved prophylactic therapy must be used.

The authors believe that early ambulation is of paramount importance in the prophylaxis of these diseases, and that anticoagulant prophylaxis should be administered in cases when early ambulation is impossible, or when a known predisposing factor to thrombosis is present, such as old age, obesity, cachexia, varicosities, disease of the blood vessels or cardiac valves, and infections.

F. J. LESEMANN, JR., M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Injuries of the Hand in Boxers (Traumatismes de la main chez les boxeurs). MARC ISELIN and JEAN DUCROQUET. *Presse méd.*, 1949, 39: 554.

The authors have had the opportunity to observe 118 cases of hand injury resulting from boxing. These cases fall into 4 groups: (1) fractures; (2) arthroses; (3) articular diastases; and (4) metacarpal bosses (which constitute a veritable stigma of the pugilistic profession).

Of the fractures encountered, the only type which affected the career of the boxer adversely were fractures of the carpal scaphoid bone. The treatment has been well established.

The arthroses or carpometacarpal interligamentous lesions were more disabling but responded fairly well to heat, massage, and physiotherapy.

The metacarpal bosses appeared to be due to dorsal thickening or tumefaction of the metacarpal bases. The authors believe that they may be prevented to a great degree by prompt novocaine infiltration of painful carpometacarpal articulations as soon as the fight is over.

EDWARD W. GIBBS, M.D.

Improved Methods in Combating Tetanus. CYRIL COSTELLO. *J. Missouri M. Ass.*, 1949, 46: 582.

The authors review the cases of tetanus seen at the St. Louis City Hospital during the last decade. It was demonstrated that fatal tetanus infections may result from what may appear to be insignificant breaks in the mucous membrane and integuments of the body. Tetanus infection continues to bear an extremely high mortality rate. Improved treatment methods have not been generally adopted. The failures of antitetanic serum as an adequate prophylactic agent are enumerated.

In the management of tetanus the following procedures are suggested:

1. Combat toxin present.
   a. 50,000 units antitetanus serum intravenously immediately and 20,000 units intravenously or intramuscularly each succeeding day.
   b. Methenamine gr. XV intravenously 2 hours after intravenous dose and from 10 to 12 hours after intramuscular dose.
2. Combat toxin production.
   a. Immediate excision of local lesions when possible.
   b. Culture douche for infected abortions.

c. $KMNO_4$ packs to wound. Infiltration with 10,000 units antitetanus serum through tissues adjacent to wound at time of excision.

3. Combat convulsions.
   a. From 20 to 40 c.c. of paraldehyde, orally or rectally pro re nata.
   b. Intravenous administration when necessary.
4. Combat and prevent complications.
   a. Protect patient with side canvas or net.
   b. Administer penicillin.
   c. Give CO_2–O_2 mixture for 1 minute every 2 hours.
   d. Continuous O_2
   e. Observe closely for stridor and keep tracheotomy set at the bedside for use if needed.

Do not give antitetanus serum intrathecally.
Do not ignore "healed" or "nearly healed" lesions.
Do not use barbiturates, ether, curare, or phenol.

Guide for Prophylactic Treatment of Tetanus:

1. Administer 1 c.c. of tetanus toxoid subcutaneously.
2. Follow in from 2 to 3 months with a second injection of the same substance.
3. Administer 1 c.c. of tetanus toxoid at such times that an individual thus basically immunized sustains an injury which breaks continuity in the skin or mucous membrane.
4. If there is doubt as to whether basic immunization has been performed, administer 1 c.c. of tetanus toxoid and antitetanic serum.

A large chart is included giving adequate details about each of the 26 patients who were treated during the last 10 years. Of these, 21 died.

Respiratory failure was a striking feature of the death in fatal cases despite artificial maintenance of respiration in some instances. In those patients who recovered the incubation period varied from 1 day to 19 days, while in those who died the incubation period varied from 5 days to 6 weeks. There was no discernible relationship between the incubation time and the course of the disease or mortality.

C. Fred Goeringer, M.D.

ANESTHESIA

Anesthesia and Surgery in Patients of Advanced Age. Paul H. Lorhan. *Current Res. Anesth.*, 1949, 28:190.

Surgery in the aged requires more meticulous attention to certain details than in the average adult patient. Careful preoperative care of the patient is essential, and supportive and corrective measures should be undertaken before operation is contemplated.

A constant observation in the aged is lowered metabolism and depression. This presents problems regarding proper premedication and the selection of the anesthetic agent. The depressed state may persist into the postoperative period and may be the predisposing factor to a pulmonary complication or a cardiac collapse. In general, barbiturates, morphine, and scopolamine are poorly tolerated and may produce alarming symptoms before and during operation. Rectal anesthesia, vasoconstrictors, and spinal blocks above the tenth dorsal segment should be avoided. Methods of choice include local and regional procedures and gas anesthesia with curare.

The maximum operating time should never exceed from 45 to 60 minutes if the morbidity and mortality is to be kept low. The depth of anesthesia is important, for if it is necessary to maintain these patients in deep surgical anesthesia for more than 30 minutes a majority of them will expire postoperatively. In the immediate postoperative period efforts should be made to maintain body heat and adequate oxygenation and to restrict the use of sedatives to the actual needs of the patient.

Mary Francis Poe, M.D.

Anesthetic Management of the Patient with Thyroid Disease. L. H. Mousel and Charles S. Coakley, *Anesthesiology*, 1949, 10: 444.

This discussion of the common problems encountered in patients with thyroid disease is based on a classification of the diseases of the thyroid gland according to pathologic manifestations. The chief problem in colloid and adenomatous goiters without hyperthyroidism will be the maintenance of an adequate airway in the patients exhibiting obstruction and dyspnea. Most of these patients are excellent subjects for local anesthesia or the combination of a local anesthetic with one of the analgesic gases. Patients who have adenomatous goiter with hyperthyroidism or exophthalmic goiter require the benefit of a complete medical survey and preoperative treatment. Many of these can be successfully managed under local anesthesia.

In patients who have been treated preoperatively with thiouracil or propylthiouracil, severe hemorrhage may be anticipated unless iodine therapy has been carried out to reduce the vascularity and the size of the gland. Most thyroidectomies can be performed successfully and safely under inhalation anesthesia without endotracheal intubation. However, endotracheal anesthesia should not be denied if an adequate airway cannot be established early. Radical resection for carcinoma of the thyroid and operation for a substernal or intrathoracic goiter require the same protection.

Because of its cardiac effects, cyclopropane now is considered unsuitable for use in patients who have toxic manifestations. The fact that procaine given intravenously tends to decrease cardiac sensitivity does not eliminate this contraindication to the use of cyclopropane. Mary Francis Poe, M.D.

Continuous Peridural Anesthesia and Analgesia for Labor, Delivery, and Cesarean Section. Charles E. Flowers, Jr., Louis M. Hellman, and Robert A. Hingson. *Current Res. Anesth.*, 1949, 28: 181.

This article represents a preliminary report of the use of continuous peridural anesthesia and analgesia in obstetrics with the Tuohy needle and plastic tubing. The sixteen nerves carrying the afferent stimuli of the pain of parturition may be blocked

through three routes. In the peridural approach, insensibility to pain is produced by the injection of an anesthetic drug between the vertebral spines and beneath the ligamentum flavum into the extradural space. Notwithstanding definite indications of a properly placed catheter and needle, there are two safeguards of the utmost importance: first, the use of two test doses of the anesthetic solution to insure the absence of spinal anesthesia, and second, the ready availability of oxygen, vasopressors, and fluids.

Peridural analgesia and anesthesia have been found applicable to any normal patient in active labor. They can be seriously considered in four specific groups of obstetric patients: seriously ill patients, patients who cannot be given caudal analgesia, patients with disease of the central nervous system when regional anesthesia is indicated, and patients who require cesarean section. The somatic level of anesthesia and the blood pressure must be carefully observed. The level of anesthesia should not rise above the tenth thoracic nerve nor fall below the twelfth thoracic nerve.

MARY FRANCIS POE, M.D.

Anoxia and the Central Nervous System. A Review and Case Report. DONALD L. BURDICK, JAMES R. LISA, and MIGUEL G. ELIAS. *Anesthesiology*, 1949, 10: 369.

The untoward reactions to, and injurious sequelae of, sudden and severe episodes of hypoxia and anoxia have been known a long time. The fundamental physiology of the problem has been clearly presented as a fifth type of "combined anoxia," suggested in addition to the usual classification.

The isolated existence of one type of anoxia for any considerable period of time probably is rare, if not impossible. An acute onset of one form may establish a cycle of events which will rapidly initiate other forms of oxygen want. Prompt institution of therapeutic measures to restore as rapidly as possible a normal physiologic state is imperative if a vicious cycle is to be avoided or broken if once established. The recognition of the combined forces of anoxia should be emphasized if all possible means for restoration to the normal are to be employed. The term "combined anoxia" as suggested seems fully warranted. A case is reported which demonstrates the unfavorable outcome of acute anoxia due to sudden hemorrhage. MARY FRANCIS POE, M.D.

Narcosis with Pentothal Sodium Alone Compared to That with Pentothal Sodium Combined with (1) Curare or (2) Myanesin. JOHN A. PAULSON, JOHN S. LUNDY, and HIRAM E. ESSEX. *Anesthesiology*, 1949, 10: 387.

The authors were chiefly concerned with the anesthetic effects of pentothal sodium as compared to those of the pentothal sodium-curare combination. Experiments on rats, guinea pigs, rabbits, and dogs were designed to determine whether anesthesia with pentothal sodium was prolonged when d-tubocurarine chloride was combined with the former. Effective doses of pentothal sodium and d-tubocurarine chloride per kilogram were determined. The amount of pentothal sodium used was that amount which was necessary to cause loss of the righting reflex. The amount of d-tubocurarine chloride used was that amount which was necessary to cause generalized paralysis of the animal without respiratory paralysis.

In the control series, pentothal sodium was given in the effective dose as described in the preceding paragraph, and the narcosis time was determined. In the experimental series, the same dose of pentothal sodium was given as in the control series, but an effective dose of curare as described was contained in the pentothal sodium solution. The narcosis time was determined and compared with that of the control series.

All injections in the guinea pig, rabbit, and dog were intravenous and were given in 1 minute. In the white rat, all injections were intraperitoneal and the injection time was not controlled. The only animals that died as a result of the experiments were some of the guinea pigs and white rats that received the pentothal sodium-d-tubocurarine chloride solution. No animals died from pentothal sodium alone in the doses used.

No significant difference was found between the narcosis time in the pentothal series and the narcosis time in the pentothal-d-tubocurarine series in any of the four species of animals used.

The property of myanesin which attracted the most attention was its ability to produce muscular relaxation, and even complete paralysis in larger doses, with relatively little effect on the respiration.

The effects of a new muscle-relaxing drug, α:β-dihydroxy-γ-(2 methylphenoxy)-propane (myanesin), have been studied. The drug has been said to potentiate the anesthetic effects of barbiturates. Experiments were done with rabbits and guinea pigs to determine whether or not myanesin would potentiate the anesthetic effects of pentothal sodium. No potentiation was observed.

Heart perfusion experiments were done to determine the possible effects of myanesin on the heart. It was found that myanesin in high concentration has a deleterious effect on the perfused heart.

Prolonged Spinal Analgesia with Epinephrine, Pontocaine, and Dextrose. JAMES ROONEY and MARY KARP. *Current Res. Anesth.*, 1949, 28: 156.

Four hundred sixty-seven cases of spinal analgesia were studied to determine the effect of epinephrine when injected with pontocaine dextrose intrathecally. The cases were divided into four groups: the single and fractional cases of spinal analgesia in which epinephrine was not added to the pontocaine dextrose solution, and the single and fractional cases of spinal analgesia in which epinephrine was added.

It was determined by volume that the amount of 1-1000 epinephrine solution which adhered to the

interior of a 5 c.c. syringe and needle varied between 2 and 4 minims. Thus, from .00012 to .00025 gm. of epinephrine was used per dose of analgesia agent. The epinephrine syringe technique is presented.

Clinical data demonstrated that epinephrine administered intrathecally sustained pontocaine analgesia from 20 to 70 minutes (from 35 to 50 per cent) above that usually produced by pontocaine alone, and was accomplished with a 10 per cent reduction of the pontocaine dosage. No deleterious effects of the method were noted.

Intravenous Pentothal-Procaine Anesthesia. R. J. FRASER. *Current Res. Anesth.*, 1949, 28: 203.

Since procaine has been given alone, it was suggested that the addition of pentothal should improve the effect. Fraser reasoned that the toxic effects of procaine should be decreased, and, with the protective action of the added pentothal, larger quantities might possibly be given. Experimentation showed that pentothal and procaine could be mixed in certain dilutions without precipitation. The mixture was used primarily for extra sedation, secondarily for postoperative relief of pain. It has been used frequently for all types of operations and with different types of anesthetics. In certain selected cases pentothal-procaine has been used alone in dilution as an anesthetic agent. It is best used as an adjuvant to strengthen the action of other anesthetic agents rather than as an anesthetic agent by itself, especially when the operation calls for muscular relaxation and more particularly with the young robust patient. On the other hand, with good premedication, older people can be controlled well with the intravenous administration of pentothal-procaine, together with one of the curarizing drugs, even for intra-abdominal work. Its prime use in anesthesia, however, is for extra sedation, cardiac regulation, and postoperative sedative action.

The preparation of pentothal and procaine, favored by the author for the majority of the work, is as follows: to 1 liter of 5 per cent glucose in normal saline solution is added 1 gm. of pentothal sodium and 1 gm. of procaine hydrochloride. There have been no ill effects. Procaine with pentothal in dilution is looked upon as an aid in anesthesia to be used primarily for the well-being of the patient, the protection of the cardiac conducting mechanism, the relief of pain, and the promotion of urinary excretion.

MARY FRANCIS POE, M.D.

The Effect of Blood Pressure Rise on the Production of Cyclopropane-Epinephrine Induced Cardiac Irregularities. QUILL MURPHY, C. W. CRUMPTON, and WALTER J. MEEK. *Anesthesiology*, 1949, 10: 416.

Ventricular tachycardia during cyclopropane anesthesia is not produced by a compression of the aorta which raises the blood pressure to a level comparable to a test dose of epinephrine. Small doses of epinephrine which do not raise the blood pressure more than from 6 to 12 mm. may produce irregularities. The usual test doses of epinephrine may produce ventricular tachycardia even when a pressure stabilizer either practically eliminates the rise or greatly reduces it. These findings are in agreement with the results from such procedures as decerebration, cardiac sympathectomy, and the administration of such drugs as ergotamine. There is strong evidence for the belief that a rise in blood pressure is not the cause of the irregularities but that they are in some way due to the action of the epinephrine itself.

On the other hand, there is evidence that the rise in pressure may have a favorable effect on the appearance of the tachycardia. In 3 experiments the results were definitely more severe when the pressure was allowed to rise, and in the last 5 experiments it is fair to say that the threshold for the epinephrine action may have been lowered as a result of the rise in pressure, and thus a dose previously inactive became effective.

BENJAMIN GOLDMAN, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Some Recent Results with My Kymographic Method. (Multiple Centers Rotating Kymography.) MARIO LENZI. *Acta radiol.*, Stockh., 1949, 31: 358.

The author gives a brief description of his rotating kymograph and relates how his examinations are performed. In essence, a circular grid is substituted for the conventional parallel grid, with slits 2 mm. in width. A preliminary film is taken by kymography of the part to be examined and the radius of curvature of the surface in question is determined. The grid is then transferred to the patient's skin and its center is placed over the proper mark. Both fixed and moving grid rotating kymograms are taken.

A comparison of rotating kymograms in relation to the conventional "Strumpf" kymograms is given for the diaphragm, bladder, and heart.

S. H. SEAL, M.D.

Angiographic Studies of the Cerebral Vessels in Arteriovenous Aneurysms. R. BUNNER. *Acta radiol.*, Stockh., 1949, 31: 233.

About 75 arteriovenous aneurysms have been outlined by angiography at the Serafimal Hospital, Stockholm, Sweden. Sixteen of these angiograms have been repeated postoperatively in from 2 weeks to 1 year, in order to see if the extirpation of the aneurysm had been sufficiently radical and to study secondary circulation changes in the arteries.

Angiography shows obvious, rather even dilatation of the vessels feeding the aneurysm in a retrograde direction extending to the carotid bifurcation. Postoperatively in all cases the dilatation regressed or diminished markedly, sometimes within 2 weeks after operation. This seems to indicate that dilatation is secondary to the aneurysm rather than to the degenerative vessel wall changes as formerly described by Mont Reid.

JANE C. MACMILLAN, M.D.

Pulsating Exophthalmos Due to Defective Development of the Sphenoid Bone. E. GRAEME ROBERTSON. *Am. J. Roentg.*, 1949, 62: 44.

After reviewing the rather meager literature on the subject the author reports a case of unilateral pulsating exophthalmos due to the defective development of the bone wall of the orbit.

The condition, which is very rare, was first described clearly by Dandy in 1929. His patient, a girl 16 years of age, showed on roentgen study the absence of the posterior half of the roof of the orbit suggestive of a congenital defect. Dandy successfully operated upon the patient by inserting a piece of the outer table of the skull into a tunnel between the dura and the orbital contents.

The author's patient was a man, 37 years of age, who, since the age of 14, noticed a slight prominence and pulsation of the left eye. He suffered no inconvenience until 3 years prior to his examination when he developed conjunctivitis, later associated with intermittent pain.

At the time of the examination there was an exophthalmos of the left eye with slight depression. The amplitude of the pulsation was slightly less than 1 mm. There was also a slower movement of the eyeball, synchronous with respiration, with an amplitude of about 0.75 mm. Compression of the jugular veins caused further protrusion of the eye. Compression of the left carotid artery lessened the amplitude of pulsation, while bilateral compression abolished it. It was possible to push the eye back into the orbit by pressure on the closed eyelids. No bruit was audible and the fundi were normal.

Roentgenograms revealed the absence of the orbital plate of the frontal bone, the lesser wing of the sphenoid, and the orbital plate of the greater wing. The pituitary fossa was enlarged and the anterior wall was straight. A normal optic foramen with a large pneumatized anterior clinoid process was seen on the right side, while on the left side the corresponding structures were absent.

The initial pressure of the cerebrospinal fluid was 170 mm. This was rapidly raised to 550 mm. by compressing both jugular veins, and to 480 mm. by pressure on the right jugular vein, while pressure on the left jugular vein caused a rise of only 50 mm. Pressure on the left eye caused a rise of 25 mm. within 2 seconds, followed by a slower rise to 380 mm. in 10 seconds. Further pressure produced marked discomfort, which indicated that the rise of pressure was the result of an increase in the bulk of the intracranial contents.

Encephalograms revealed the presence of an orbital encephalocele, due to the defective development of the orbital wall. There was a collection of gas below the level of the superior orbital margin, extending across the width of the left orbit. The upper part of the shadow was indented, corresponding to the convolutions of the inferior surface of the frontal lobe. Subsequent inquiries of the patient's mother elicited the fact that the anomaly had been present since birth.

Laminagrams made in different planes and at different levels showed the bone defect to considerable advantage.

As a result of the patient's hospitalization the pain disappeared and, therefore, no operation was advised.

In discussing the pathogenesis the author states that the accepted descriptions of ossification of the sphenoid bone afford no clue to the pattern, and the constancy of pattern, of the defect. The constant enlargement of the sella is attributed to maldevelopment of the fossa rather than to an enlargement of the pituitary gland. It thus seems that the defective development is due to some regional cause affecting

all the bones in this region. The orbital plate may fail to develop because of the absence of the lesser wing of the sphenoid with which it articulates.

Once the condition is known, diagnosis is simple.

The article contains roentgenograms, encephalograms, and laminagrams. T. LEUCUTIA, M.D.

Solitary Tumors of the Chest; the Differential Diagnosis in 50 Proved Cases. ROBERT K. ARBUCKLE. *Am. J. Roentg.*, 1949, 62: 52.

The author reviewed 50 proved cases of solitary tumors of the chest with the purpose of determining the relative value of the various methods of diagnosis. In 9 patients the tumor was found during routine mass survey of the chest.

The commonly used diagnostic methods are discussed in considerable detail.

Roentgenoscopy of the chest. This must be done routinely. The vocal cords should be studied both while at rest and during phonation. Aneurysm of the aortic arch frequently causes paralysis of the left recurrent laryngeal nerve. If the upper mediastinal tumor is associated with paralysis of the vocal cord it most likely is of the invasive type. Elevation of the diaphragm, with paradoxical motion indicates involvement of the phrenic nerve. The presence or absence of pulsation of the mass is of questionable significance. Examination of the esophagus by means of a barium mixture often gives information concerning the relationship of the mass to this organ.

Roentgenographic study. In addition to the films made in the conventional posterior, anterior, and lateral views, a Potter-Bucky film is also recommended. If the mass is located near the esophagus an additional film with a barium-filled esophagus is of considerable help. The roentgenograms are studied for: (a) bone erosion, (b) the presence of calcium, (c) location of the mass, (d) effect on the adjacent structures, and (e) pleural effusion.

Bronchoscopy. This method is of little value in the solitary tumors of the chest. The detection of a paralyzed vocal cord, fixation of the trachea, or compression of a bronchus may be of limited help in determining the operability of the tumor.

Sputum study. The author made sputum examinations in only a few cases but believes that more routine study is warranted.

Planigraphy, thoracoscopy, and lipiodol bronchography. These proved of little value in making a differential diagnosis.

Study of the pleural fluid. Bloody pleural fluid is not always indicative of a malignant tumor and should not contraindicate exploration.

Response to irradiation. The roentgen therapeutic test dose is of greater value in the mediastinal tumors than in the solitary tumors of the lungs.

Hormone assay. This was not done.

Artificial pneumothorax. Advances in thoracic surgery made this procedure obsolete. It may have some value in determining whether a mass is within the lung or adjacent to it in the pleural space or mediastinum.

Aspiration biopsy. This method is strongly endorsed in all cases, including aneurysms. It is the author's opinion that teratomas, cysts, carcinomas, sarcomas, aneurysms, and lymphoblastomas can be confirmed or ruled out with a high degree of accuracy by needle aspiration biopsies. The technique described by Martin and Ellis in 1934 is used. The aspiration is carried out under biplane roentgenoscopic control. In solid tumors a negative report has little significance unless repeated three or four times. When a mass is so situated that an aneurysm must be considered a diagnostic possibility, a very thin needle is used. On several occasions attempts were made to aspirate tuberculomas but the needle would not penetrate them. It was possible to make an accurate diagnosis by means of needle aspiration under roentgenoscopic guidance in 74 per cent of the cases.

The tumors of the entire series fell into the following categories: carcinoma of the lung (17 cases): (1) bronchial carcinomas originating adjacent to the mediastinum and oval or spherical in outline, and (2) primary spherical parenchymal tumors; tumors of nerve tissue origin (11 cases): (1) neurofibromas or neurinomas developing from the nerve sheaths and occurring anywhere along the course of the nerve, and (2) ganglioneuromas developing in the cells of the peripheral nervous system, commonly in the sympathetic ganglia; carcinoma of thyroid (1 case); bronchiogenic cyst (2 cases); aneurysm of the innominate artery (2 cases); aneurysm of the aortic arch (3 cases); teratoma (2 cases); thymoma (2 cases); mycelia of fungus (1 case); adenoma of bronchus (2 cases); Hodgkin's disease (3 cases); and other tumors (4 cases).

The representative cases are illustrated with their respective roentgenograms. There are no roentgen findings that can be considered characteristic of any particular type of tumor. T. LEUCUTIA, M.D.

Spontaneous Pneumothorax: A Study of 105 Cases. LOUIS A. ROTTENBERG and ROSS GOLDEN. *Radiology*, 1949, 53: 157.

The authors studied a series of 105 consecutive cases of spontaneous pneumothorax observed at the Columbia-Presbyterian Medical Center from 1930 to 1947, inclusive.

It is generally assumed that the three most common causes of spontaneous pneumothorax are (1) pulmonary tuberculosis, (2) congenital vesicles, and (3) emphysema. The authors give a detailed review of the salient articles in the literature dealing with the incidence of pneumothorax in these conditions. A total of 570 cases was collected from 13 authors, in which a simple spontaneous pneumothorax was observed in apparently healthy subjects.

In the authors' series the spontaneous pneumothorax was complicating a current intrathoracic disease in only 8 instances (6 of pulmonary tuberculosis, 1 of pleural carcinomatosis, and 1 of suppurative pleurisy). In 97 cases it occurred in apparently healthy individuals. Of these, 27 have been followed

up from 1 to 5 years, 15 from 5 to 10 years, and 7 from 10 to 18 years after the initial pneumothorax.

Eighty-seven of the cases occurred in men and 10 in women. The average age was 30.2 years, with the youngest patient 17, and the oldest 71 years. Only 9 of the patients gave a history of exertion at the time of the attack. In the others the pneumothorax occurred while in bed, sitting in a chair, or walking.

The two major symptoms experienced by all patients were pain and dyspnea. Nine of the patients required thoracocentesis and removal of air from the thorax to relieve the dyspnea.

In 47 per cent of the cases roentgen examination revealed evidence of slight to moderate amounts of pleural effusion which was usually absorbed spontaneously. This is an important observation since the presence of fluid has been considered erroneously by many authors as a sign of tuberculosis. Massive hemothorax developed in 3 patients requiring thoracocentesis.

The average time required for re-expansion of the collapsed lung was 4 weeks, the shortest being 6 days and the longest 12 weeks.

Sixteen patients had one recurrence, and 8 had two or more. The average time between attacks was 23.2 months. In 5 cases the recurrence was observed 5 or more years after the initial pneumothorax. Five developed pleural adhesions with fibrous bands.

Two deaths occurred, one as a result of tension pneumothorax which could not be relieved by surgical intervention and the other as a result of massive hemothorax.

The conclusion is reached that pulmonary tuberculosis, if not present at the time of the attack, rarely develops subsequent to the spontaneous pneumothorax. T. LEUCUTIA, M.D.

Arteriovenous Aneurysm of the Lung. A Case Report. ALICE ETTINGER, H. MAGENDANTZ, and E. A. RUSSO. *Radiology*, 1949, 53: 261.

The authors present a case of pulmonary arteriovenous aneurysm in which the diagnosis was made roentgenologically and surgical cure was achieved by lobectomy. A lobulated mass connected with the hilus by bandlike vascular shadows is highly suggestive of arteriovenous aneurysm. Pulsation may be seen fluoroscopically in some cases. Kymographic examination may be of value. Laminography is frequently helpful in demonstrating the connection of the tumorlike shadow with the hilar region. Angiography has been used but may be of some danger to the patient. The Valsalva test as a means of establishing the vascular nature of the lesion is of value.

The clinical syndrome of polycythemia, cyanosis, clubbing of the fingers and toes, repeated hemoptysis, breathlessness, faintness, dizziness and weakness, and a distant bruit or hum in the chest, associated with a pulmonary shadow and roentgen evidence of small hemangiomas in the upper respiratory tract should arouse suspicion of arteriovenous aneurysm. There is also an increase in the circulating blood volume in arteriovenous aneurysm.

The authors stress the importance of prompt recognition in that death by massive hemoptysis occurs in untreated cases as a rule.

FRANK L. HUSSEY, M.D.

The Angiographic Demonstration of Pulmonary Arteriovenous Fistula. CHARLES E. DUISENBERG, and LUIS ARISMENDI. *Radiology*, 1949, 53: 66.

Twenty-two published cases of pulmonary arteriovenous fistula are reviewed and 1 case is added by the author. In this case, the diagnosis was made by injecting an unstated amount of 70 per cent diodrast solution into the antecubital vein. Rapid sequence roentgenography showed the accumulation of radiopaque material in a circumscribed lung area 1.5 seconds after the injection and its disappearance after 5.25 seconds.

A lobectomy of the right lower lobe was then performed on this 26 year old male. An arteriovenous fistula was found. The patient made an uneventful recovery. Six months after the operation the red cell count dropped from 5,800,000 to 5,300,000.

GERHART S. SCHWARZ, M.D.

Diverticula of the Esophagus. A. S. JOHNSTONE. *Brit. J. Radiol.*, 1949, 22: 415.

As one of the participants in a symposium on diverticula of the alimentary tract, Johnstone presents a general discussion of diverticula of the esophagus.

Pulsion diverticula, produced by protrusion of the esophageal wall under the effect of intraluminal pressure, are found posteriorly at the pharyngoesophageal junction (about the level of the cricoid cartilage). The muscle fibers are normally sparse in this area and may eventually allow the mucosa to balloon outward in persons having abnormally prolonged contraction of the cricopharyngeus muscle during swallowing, with resultant increased intraluminal pressure.

Traction diverticula, usually found anteriorly in the middle segment of the esophagus, are thought to be due to an outward pull on its wall by the contraction of scar tissue. Also, since these diverticula are often found in elderly people who show some unfolding of the aorta, and the esophagus follows the aorta as it uncoils, any adhesion present may create backdrag on the esophagus and cause localized outpouching. Once formed, a traction diverticulum tends to become enlarged because of the pulsion effect.

The author disagrees with the widely held opinion that diverticula in the lower third of the esophagus arise because there is some obstruction present there which raises intraluminal pressure. He feels, rather, that they are more likely due to scar tissue contraction.

To be considered in differential diagnosis are small hiatus hernias adjacent to the esophagus and partial reduplication of the esophagus. Diverticula rarely produce symptoms unless very large or accompanied by complications, which include ulceration, abscess

formation, perforation, bronchial fistula, mediastinitis, and malignancy.

Treatment is not discussed.

W. C. Owsley, Jr., M.D.

Diverticula of the Esophagus. A. L. d'Abreu. *Brit. J. Radiol.*, 1949, 22: 423.

Most diverticula of the esophagus are pulsion diverticula, as demonstrated by their smooth outline. Those resulting from outside adhesions (traction type) are "spiky" in configuration. Pulsion diverticula seldom are symptomatic and do not require surgery. Diverticula may be simulated at the lower end of the esophagus by ulcer, hiatus hernia, and pouch formation associated with achalasia.

An interesting case of a large congenital diverticulum of the lower portion of the esophagus simulating a lung abscess is presented along with 3 other illustrative case histories. Pharyngoesophageal diverticula are also briefly discussed.

Allan K. Briney, M.D.

The Roentgenological Aspects of Diverticula of the Stomach and Small Bowel. Richard Fawcitt. *Brit. J. Radiol.*, 1949, 22: 427.

In patients who complain of pain in the chest, unorthodox dyspepsia, or flatulence, and in whom no evidence of ulcer, gallstones, a heart condition, or neoplasm can be found, the presence of gastric diverticula may be suspected. These diverticula have been classified morphologically into three types: (1) congenital, in which there is malformation in development but three gastric layers are intact; (2) acquired, in which organic disease has caused pouching and all three layers are present but may be thinned or broken; and (3) false, in which there is herniation of one or more of the gastric layers through the muscularis, attributed to trauma.

The author's review of the literature includes several roentgenological criteria for the diagnosis. There is usually a mobile sac with a broad or narrow neck which is unattached to extragastric tissue and presents itself as a well defined smooth and regular shadow noted from various angles. One writer describes the appearance as a nichelike opaque spot surrounded by a defect in the contrast shadow, which suggests an ulcer without surrounding infiltration. Generally there is no tenderness over the area of filling and careful technique will demonstrate the mucosal lining of the neck and in the diverticulum itself. The retention of barium in the sac for long periods of time is an important although inconsistent criterion.

A previous report of 14 cases placed 6 in the gastric cardia, none in the upper portion of the pars media, 2 in the proximal pylorus (antrum), and 6 in the distal pylorus. The writer found the highest incidence in the region of the cardia.

Differentiation from malignancy can be made on the lack of rigidity of the wall and interruption of the mucosa in cases of diverticula. If the differentiation cannot be made roentgenologically, gastroscopy may be indicated, in which case the differentiation should not be difficult if the area is visualized.

Much more has been written with respect to diverticula of the duodenum than of diverticula of other portions of the small bowel and stomach. It is believed that the congenital type is extremely rare. It is thought that the majority are acquired and are either primary or exist on the basis of either ulceration or traction, the adherent gall bladder or pancreas being potential factors. They may occur on either the lesser or greater curvature, most commonly in the second part. Primary diverticula of the first portion are definitely rare and usually occur in association with ulcer or scarring.

Jejunal involvement is indeed rare and isolated diverticula are very rare. When present, often multiple diverticula are observed throughout the jejunum and these are often associated with diverticula in other portions of the gastrointestinal tract. When there is involvement of the duodenojejunal junction, there may be an indication of obstruction further down the jejunum. The distribution is mainly in the upper part, becoming less common as the distance from the duodenojejunal junction increases. Meckel's diverticulum is mentioned as being demonstrated more often by the surgeon than by the radiologist.

In summary, the author states that in 3,000 examinations he found 5 gastric diverticula, 19 duodenal diverticula, 4 jejunal and ileal diverticula, and 2 Meckel's diverticula. Congenital diverticula may be found at any age, while the acquired type is usually discovered in middle or advanced age.

The author notes that the higher the position in the gastrointestinal tract, the more liable are the diverticula to give symptoms of atypical dyspepsia. The lower the site of the lesion, the more liable is melena to occur. In all cases the importance of multiple fluoroscopic and roentgenographic positions and projections is stressed for proper demonstration of the lesions.

Daniel Talley, III, M.D.

Diverticula of the Small Intestine. H. C. Edwards. *Brit. J. Radiol.*, 1949, 22: 437.

The author classifies small intestinal diverticula on an etiological basis.

Congenital diverticula: Meckel's and nonmeckelian, the latter being divided into giant diverticula, diverticula associated with ectopic pancreatic nodules, and cystlike diverticula.

Acquired diverticula: primary or hernial type and the secondary type; the latter are divided into diverticula due to disease of the bowel wall, i.e., ulcer diverticula of the duodenum, traction diverticula, and pseudodiverticula.

The congenital diverticula are those containing the 4 coats of the intestine. The nonmeckelian diverticula are rare and by far the most unimportant except that in unique instances they have perforated. The more common Meckel's diverticulum has an incidence between 1.5 and 2 per cent in otherwise normal individuals. Since the intestinal contents can enter and leave the wide mouth with ease, it is un-

usual to have complications. At times the obliteration of the omphalomesenteric duct is arrested and the fundus of the diverticulum remains attached to the abdominal wall. In this case, with the diverticula attached to the anterior wall and the mesentery attached to the posterior abdominal wall, an axis is formed for the bowel to rotate. If the obliteration is incomplete cysts may form in the omphalomesenteric duct.

Pancreatic tissue may be found in a Meckel's diverticulum. This tissue tends to form a mass in the fundus and may lead to acute intussusception.

Ectopic gastric epithelium may also be found in a Meckel's diverticulum. Since the ileal mucous membrane is extremely sensitive to the acid secretion, peptic ulcer with all its complications may ensue.

The primary or hernial diverticula are herniations of the mucous membrane of the bowel through gaps in the intestinal musculature. These gaps are produced by the passage of blood vessels or ducts. It is noteworthy that these hernias are not found in the first portion of the duodenum. The most common type is the perivaterian diverticulum which may cause pressure on the common bile duct and thereby produce jaundice. This type as well as the jejunal diverticulum may become inflamed and perforate. These complications are extremely rare.

The most common syndrome that primary hernias produce is flatulent dyspepsia. The author warns that before these diverticula can be blamed for the symptoms, all other possible causes must be eliminated. The diverticula should also show retention of barium long after the barium meal has passed on its way. It must be remembered that the removal of duodenal and jejunal diverticula can often be hazardous and difficult. Also, that jejunal diverticula are frequently multiple and the choice of the particular diverticula to be removed is difficult. The author emphasizes the point that they should be removed only if the symptoms are severe and the evidence indicates that they are the cause of the symptoms.

Diverticula of the first portion of the duodenum are invariably due to scarring from previous peptic ulcer. The formation of these diverticula is explained by the contracture of the scar tissue and the bulging of the remaining normal tissue. It must be remembered that the diverticula formed are composed of the unaffected bowel. Diverticula of the first portion of the duodenum are important only because they give unequivocal evidence of scar formation in the duodenum. Eleven illustrations accompany this article. JACK EDEIKEN, M.D.

Diverticulosis and Diverticulitis of the Large Intestine. J. L. A. GROUT. *Brit. J. Radol.*, 1949, 22: 442.

A short history of diverticulosis and diverticulitis is presented and it is noted that almost a complete compendium on diverticula of the intestine can be obtained from two articles, one by Telling and Gruner published in 1916 and the other by Spriggs and Marxer published in 1926.

The orifices of diverticula are often covered by coarse folds of mucous membrane and the sacs are often imbedded in the heavy fat around the bowel. Surgeons and pathologists can excusably overlook diverticula, and therefore the role of the radiologist in the study of diverticula is important.

The author studied 2,179 consecutive patients who received barium enemas and found an 8 per cent incidence of diverticula of the colon in various stages. In this series there was a predominance of males to females, the ratio being 9 to 7. There were 51 patients between 50 and 60 years of age and 61 between 60 and 70. Diverticula of the large intestine are extremely rare in individuals below the age of 40. The diverticula were rare in the appendix and rectum, and common in the descending and pelvic colon. The author presents 1 case of diverticula of the appendix.

Diverticulosis and diverticulitis are accepted terms and are relatively easy to differentiate roentgenographically. On the other hand, the prediverticular stage is difficult to diagnose.

Of 91 patients with carcinoma of the colon that the author has observed, only 8 showed diverticulosis or diverticulitis. He believes that diverticulitis bears no direct relationship to carcinoma of the colon. It is often difficult to decide whether a filling defect represents a carcinoma or a diverticulitis. It must be remembered that in the advanced type of diverticulitis a sausage-shaped tumor can sometimes be felt.

There are some roentgenologic points which make it possible to differentiate a carcinoma from a diverticulitis. In carcinoma the mucosal pattern is destroyed, whereas in diverticulitis the pattern gives a transversely puckered appearance. In carcinoma the lesion is usually abruptly demarcated from the normal bowel. In diverticulitis the diverticula can usually be seen somewhere in the large bowel.

In the treatment of diverticulosis the extent of the lesion and the clinical features decide whether surgical or medical regimes should be used. Therefore co-operation of the clinician and radiologist is needed in the diagnosis and treatment of diverticulosis.

Two tables and 16 illustrations accompany this article. JACK EDEIKEN, M.D.

Osteogenic Sarcoma—Along What Lines Should it be Treated? ERIK POPPE. *Acta radiol.*, Stockh., 1949, 31: 335.

In 1942, Eker and Poppe published a report on 42 cases of bone sarcoma treated at the Norwegian Radium Hospital between 1932 and 1937; of these, 22 were classified as osteogenic sarcoma. Three of the patients were alive and free from symptoms more than 5 years after treatment; one of them was treated by irradiation followed by amputation, 1 by curettage of the tumor followed by irradiation, and 1 by irradiation alone. Of the remaining 19 patients, some were treated by irradiation alone, some by both surgery and irradiation, and some by amputation alone. All those treated by amputation alone were dead within 3 years of operation.

The present report is based upon the primary bone sarcomas collected from the surgical departments of the University Hospital of Oslo between 1934 and 1943. There were 20 cases of osteogenic sarcoma, of which 4 were considered inoperable, either because of the site of the primary tumor or the presence of lung metastases, and they were therefore given irradiation therapy as a palliative measure. One patient treated by irradiation alone is still alive after 10 years, but has radiation necrosis of the treated bone and a pathological fracture. One patient refused treatment of any nature. The remaining 14 patients were treated by amputation, 1 of whom is alive 10 years after an amputation of the femur. The remaining 13 patients are dead.

Roentgenographic examinations of the chest were negative in all 13 patients and all amputations were carried out well above the tumor tissue. In spite of this, metastases appeared in the chest very soon after the operation. The author concludes that metastases were very likely present at the time of operation but were not demonstrable by the present means of examination. The average period of survival after amputation was 9.9 months. The average period of survival of those receiving no treatment or palliative irradiation was 10.6 months.

Since the results of amputation at the earliest possible moment are not good and the diagnosis of osteogenic sarcoma often may be difficult and remain uncertain for quite some time, the method recommended by Ferguson is given serious consideration. This is summarized as follows:

1. Amputation should not be undertaken at an early stage of the disease.
2. Preoperative irradiation, or resection of the tumor followed by irradiation is required.
3. Amputation should be performed in a quiet phase of the disease.

From the view of the radiologist, the method of treatment recommended is irradiation in large doses followed by radical amputation, regardless of the sensitivity of the tumor.

One case report of a patient receiving irradiation therapy alone is presented. No pathological material was available in this case.

ROY GREENING, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Bacteriology of Hospital Wards. J. HINGSTON. *Irish J. M. Sc.*, 1948, ser. 6: 611.

The bacteriology of hospital wards was studied by exposing agar plates to the air for from 5 to 15 minutes and by inoculating them with dust or shaking bed clothes over the agar plates.

A considerable reduction in bacterial counts was obtained by the use of vaporizer spraying of a hypochlorite solution for 7 minutes three times daily. The apparatus is simple to use. The cost is small except for the initial outlay. The solution is claimed to have no unpleasant odor. The method appeared preferable to oiling of the floors and bed clothes. Bacteriological studies are reported in detail.

ARTHUR J. LESSER, M.D.

Practical Air Disinfection with Hypochlorite in the Prevention of Cross Infection. A. H. WALTERS. *Irish J. M. Sc.*, 1948, ser. 6: 632.

The author attempts to study the role of air-borne infection in relation to infantile enteritis and diarrhea. Dust in the atmosphere, dust from the floor, droplets in the air from the mouth of speaking persons, and air-borne infection of milk, baby foods and of baby feeding bottles are considered.

A stabilized solution of hypochlorite if sprayed into the air by a special machine called a "dynalysor" will disinfect the air, although the problem in ventilated atmospheres is not simple.

Methods of routine air disinfection by "dynalysation" in hospitals and other places are discussed. The importance of hypochlorite spraying is especially stressed before and during dust-making activities.

ARTHUR J. LESSER, M.D.

The Toxic Effect of Streptomycin on the Eighth Cranial Nerve. Histological Investigations. A Preliminary Report. KARL BERG. *Ann. Otol. Rhinol.*, 1949, 58: 448.

Berg, using young cats, investigated vestibular dysfunction following the administration of streptomycin. When the crista ampullaris was removed marked degenerative changes of the sensory epithelium were observed: the nuclei of the supporting cells were displaced and total absence of cilia was found. When larger doses of streptomycin were used (960 mgm. over a period of 127 days) similar changes were also found in the sensory epithelium of the maculae utriculi and sacculi. The organ of Corti, moreover, showed considerable changes. For these reasons it was concluded that streptomycin primarily affects the sensory epithelium of the labyrinth. Slight, presumably secondary, changes have been demonstrated in the vestibular ganglion.

STEPHEN A. ZIEMAN, M.D.

Hemangiomas. J. P. REIDY. *Brit. J. Plast. Surg.*, 1949, 2: 50.

The author reviews some of the difficulties in the treatment of hemangiomas.

In general, the treatment depends upon the site and size of the tumor. As these tumors are commonly in conspicuous areas, a good cosmetic result is an important consideration. Odd forms of treatment produce some scarring and no one method of treatment is effective for every type of angioma.

Capillary hemangiomas are insensitive to radiation, and there is danger of radiodermatitis when radiation is used in their treatment.

In childhood spider nevi tend to retrogress, but if they persist or enlarge suitable application of the diathermy needle is usually satisfactory. Port-wine stains tend to fade during the first 2 or 3 years. Many are small enough for excision and suture. The larger lesions have been painted with a thorium X paste for 3 days at 3 week intervals. This gives a pale, but not perfect, skin. After midchildhood, this gives poor results.

In adult cases with facial disfigurement, one must consider carefully whether the result of treatment will not be more obvious than the original lesion. When practical, excision and suture are best, even in stages. Excision followed by skin grafting is warrantable only when the lesion is extensive.

The use of radium risks scarring, pigmentation, and ulceration.

Cirsoid aneurysms consist of an overgrowth of small intertwined arteries with fistulas into veins. Ligation of the main vessels to reduce the size, tenseness, and vascularity is the first step. This is followed later by excision of the aneurysm from beneath the scalp or excision of the scalp plus tumor and skin replacement.

Cavernous hemangiomas are composed of large intercommunicating blood spaces in the skin and subcutaneous tissue. In certain cases the site and increasing size indicate early treatment, and it is often possible to enucleate the mass from beneath the surface. However, it is difficult to be certain that all hemangiomatous tissue has been excised and so recurrence may follow.

Some of these lesions progress rapidly from bad to worse, and because of the tissue involved, even a combination of ligation of the main vessels, partial excision, and excision with skin grafts may not prove successful.

Radon seeds, radium and sclerosing solutions have also been suggested.

To summarize the treatment of large cavernous lesions:

The spongy hemangioma treated surgically involves the risk of gross hemorrhage and therefore requires a cautious approach with sclerosing agents or radiation. It is doubtful whether the later addition

of surgery, i.e., skin replacement, is justifiable, as the risk of recurrence is still present.

The infiltrating type, e.g., in lip and cheek, seems to lend itself to surgical excision as a primary procedure, with or without skin replacement, as preliminary radiation risks muscle destruction and distortion. EDMUND R. DONOGHUE, M.D.

Malignant Melanoma. WILLIAM S. MCCUNE. *Ann. Surg.*, 1949, 130: 318.

Forty patients with malignant melanoma were treated by surgical extirpation and radical nodal dissection at Walter Reed General Hospital from 1942 to 1946, inclusive. In most instances the melanoma had been removed elsewhere, often at an overseas installation, the patient being transferred to this hospital because of a malignant growth in the lesion. Except in a few far advanced cases, the procedure consisted in review of the transfer slide if available, followed by radical resection of the lymph nodes draining the area involved. The nodes were resected whether or not they were palpably enlarged. In many instances the original scar was excised and a strip of skin and fascia between it and the lymph nodes removed en bloc.

Nine of the 40 cases were regarded as far advanced, as evidenced by large, fixed, palpable lymph nodes, or distant metastases. Only 1 of the 9 patients lived for more than a few months after operation. In 3 of the 9, because of the degree of fixation of the involved nodes or because of distant metastases, biopsies only were performed.

All cases were divided into two groups, one with and one without palpable lymph nodes. There were 25 cases in which glandular enlargement was present on admission, 12 in which it was absent, and 3 in which the records were incomplete. Among the 12 cases in which no palpable adenopathy was present at the time of the lymph node resection, 7 (58 per cent) showed evidence of metastasis in the nodes removed. All of the 7 patients are now alive without evidence of further metastasis or recurrence for periods varying from 1 to 6 years since operation. Of 5 patients without palpable adenopathy or evidence of metastasis in the nodes removed, 1 died of distant metastases 4 months after operation. The remaining 4 patients are alive and well for periods varying from 1 to 3 years since resection. Only 2 of 25 patients in whom nodular enlargement was present at the time of operation failed to show evidence of metastasis in the nodes removed. One of these patients is alive and well 2 years and 9 months after operation, and the other has shown roentgenographic evidence of a metastatic lung tumor 2 years and 6 months after resection. Of the remaining 23 patients with palpable adenopathy and evidence of metastasis, 20 are dead, 18 having died in less than 2 years after operation. One is alive with metastases 1 year after operation, and 2 have been well for more than 2 years.

A comparison of results in these two groups of cases demonstrated conclusively the importance of early radical resection of regional lymph nodes, whether or not they are enlarged, whenever a diagnosis of malignant melanoma is made. To wait for clinical enlargement of regional nodes before undertaking their block dissection is to ensure a high percentage of recurrences. Eighty per cent of the patients in this series who had palpably enlarged nodes at the time of operation are now dead or show evidence of recurrence. All of the patients without such preoperative nodular enlargement are now alive and well. BENJAMIN GOLDMAN, M.D.